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Some 45 public and private schools were involved in planning for coordinated data processing services. Considerable emphasis was placed on inclusion of in-service activities for school personnel in connection with the planning. The personnel, through questionnaires, indicated the anticipated value of the benefits of the plan. The questionnaire findings showed the only significant utilization of data processing equipment involved a fraction of the students in scheduling and mark reporting. Teachers indicated a need for curriculum development and in-service education in connection with instructional uses. Recommendations are as follows: (1) if schools with an aggregate population of 100,000 agree to participate in an operational project, a grant application should be submitted, (2) personnel, equipment, and facility should be acquired by and under the control of the participating schools, (3) service categories should include information concerning students, administration and finance, materials, and instruction, (4) staff consultants should be hired for each information area, and (5) system design activities, for integration of information, should be planned. Membership dues and requirements are discussed. (Author/JS)

ED028466

COORDINATED DATA PROCESSING PLANNING PROJECT

for

The Educational Research and Development Council
of the Twin Cities Metropolitan Area, Inc.

November, 1966

BROEKER HENDRICKSON & CO.
Certified Public Accountants
NORTHWESTERN BANK BUILDING · MINNEAPOLIS, MINNESOTA

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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ABSTRACT

COORDINATED DATA PROCESSING PLANNING PROJECT

This project was undertaken by ERDC and involved 45 public and private schools to plan for coordinated data processing services. The technical feasibility of providing data processing services was assumed at the outset. The study was very broad with respect to the services that were considered. These included instructional uses.

Considerable emphasis was placed upon inclusion of in-service activities for school personnel in connection with the planning and thus the questionnaires for data collection contained considerable explanatory material concerning the nature of a potential data processing services. Additionally several in-service seminars were held for school personnel.

Personnel from each school system were asked to indicate in the questionnaires the relative benefit of the many applications that could be provided them. Such a numerical value became an important criterion in later determining the priorities for offering of services.

The findings from the questionnaires indicated that approximately 220,000 K-12 public school students and 71,000 Catholic parochial school students could be considered for near term involvement in an operational project. The only significant utilization of data processing equipment or service by the above schools involved less than 45,000 secondary students in scheduling and mark reporting. Substantial needs were indicated for instructional uses of computers, particularly in mathematics and business education curriculum. Teachers indicated strongly the need for curriculum development and in-service education in connection with instructional uses.

If schools with an aggregate population of 100,000 agree to participate in a operational project, this report recommends that a grant application be submitted under P.L. 89-10, Title III by January 15, 1967.

The report recommends that personnel, equipment and facility be acquired by and under the control of the participating schools.

The comprehensive services to be offered would fall in four general information systems (1) Student (2) Administrative/ Finance (3) Materials (4) Instructional Uses.

Student would have certain sub-systems (a) scheduling (b) mark reporting (c) attendance (d) guidance (e) census/ elementary (f) guidance. Administrative/Finance would include

(a) employee information (b) accounts payable (c) appropriation and budgetary (d) property records (e) purchasing and inventory (f) transportation (g) food service (h) maintenance. Materials would have two sub-systems, library and audio-visual. Instructional uses would focus on curriculum development for mathematics and business education as a first priority and subsequently on social studies and science. All of the above activities would have extensive in-service education associated with them.

Four staff consultants for each of the four subjects areas are planned. Additionally, staff consultants are provided for in advanced computer related instruction, educational research and materials information systems.

Systems design activities are recommended to focus on integrated (or total) information systems so that components fit together. Systems design is also to incorporate the development of electronic student records, education research, functional accounting systems and decentralized budgetary systems.

Initial services are scheduled for offering in early fiscal 1969. They would include employee information, scheduling, mark reporting, attendance, guidance and test scoring and analysis. Beginning with fiscal 1969 appropriation and budgetary accounting would be offered and involve the use of communication lines and terminals for account status inquiries. The plan also calls for the initial instructional uses in Sept. of 1969, though that could occur at an earlier date. Other services would be offered in 1970 and subsequent years.

Annual membership dues based on student population are recommended as a means of financing the project. Different dues schedules would be in effect for different types of schools. The dues would escalate from fiscal 1967 to 1972 as follows:

Public K-12	$.75 to $5.00
Non Public 1-8	.27 to 1.80
Non Public 9-12	.73 to 4.85

The report also recommends that schools joining after fiscal 1967 pay back dues or a prorata share of the development costs as determined by the governing body. Schools would also incur certain on-premise expenses for their coordinator, keypunch personnel, equipment etc.

A summarization of forecasted dues income through 1972 is set forth below and assumes that 205,000 K-12 public students would be in the project by that year. A similar summary of expenses is indicated as is deficit/surplus:

	Fiscal Years			(Thousands Omitted)		
	1967	1968	1969	1970	1971	1972
Forecasted Expenses	$74	$444	$746	$906	$946	$1,055
Forecasted Dues Income	83	143	405	605	965	1,080
Surplus/Deficit	9	(301)	(341)	(301)	19	25

It is anticipated that P.L. 89-10, Title III would be a source of funds to cover the deficit.

Any material delay in starting systems design activities after March 1967 is likely to delay services by approximately one year.

ACKNOWLEDGMENTS

We wish to express our appreciation to the Executive Secretary of ERDC, Dr. Van Mueller, for his outstanding contributions to this project and report. Dr. Donald Davis, Assoc. Executive Secretary of ERDC also gave the project important guidance. Dale Johnson, Jeremy Hughes, Gerald Mansergh and John Maas made many important contributions to the project and this report.

We also wish to express our appreciation to the Project Advisory Committee, the personnel from the school systems participating in the study and many others whose efforts were important to this project.

Broeker Hendrickson & Co.

BROEKER HENDRICKSON & CO.
November, 1966

I. PURPOSE AND PHILOSOPHY OF PLANNING STUDY

This application requested funds for the planning of a Coordinated Educational Data Processing Facility to provide the coordination of data processing and computer services to the thirty-eight public school districts associated together as the Educational Research and Development Council (ERDC) of the Twin Cities Metropolitan Area, Inc. Planning proceeded upon the premise that services would be made available to public and private schools not members of ERDC on the same basis as such services are made available to member schools. It was proposed that such a center would be developed in close coordination with the Minnesota State Department of Education and serve as a model for other areas of the state.

Such a system would include provision of data processing services to schools where necessary, but primarily coordinate the development of services in school systems; provide for the automatic generation of required educational data to the Minnesota State Department of Education; serve as a center for research and development of computer applications in educational management and instruction and provide for a continuous program of in-service training for school personnel.

The over-all purpose of this study then was not to test the technical feasibility of establishing a Coordinated Educational Data Processing Facility. Rather, because of the prior existence of similar centers in New England, Michigan, New York, Florida, California and other states, the technical feasibility of such a venture was assumed.

From the outset of this study, a conscious effort was made to be sensitive to, and in all ways possible include, school personnel in its planning, execution, evaluation and preparation of this report. The belief existed that far too often in the past, data processing services have been arbitrarily made available to schools without reference to relative benefit and sometimes the services have been poorly designed because educational personnel were not deeply involved in this activity. Frequently in the past, school personnel were not informed adequately in advance of the full ramifications and implications of the services offered. This study was to provide in-service type activities (i.e., school visitations, seminars, and the nature of the questionnaires themselves) to at least partially correct some of the deficiencies in earlier uses of data processing services.

II. SCOPE OF PLANNING STUDY

Forty-eight public and private schools participated in the study. Altogether in excess of one thousand school personnel participated in the completion of questions, attended seminars or were otherwise involved in the planning activities. To facilitate data analysis, participating schools were categorized as follows:

Group 1 (Large: 3,001 -- 8,000 Secondary Enrollment)
Anoka, Bloomington, Edina-Morningside, Hopkins, Moundsview, North St. Paul, Richfield, Roseville, St. Louis Park, White Bear Lake.

Group 2 (Medium: 1,301 -- 3,000 Secondary Enrollment)
Burnsville, Columbia Heights, Forest Lake, Fridley, Minnetonka, Mound, Osseo, South St. Paul, Spring Lake Park, Stillwater, Wayzata, West St. Paul.

Group 3 (Small: 1 -- 1,300 Secondary Enrollment)
Brooklyn Center, Centennial, Chaska, Farmington, Golden Valley, Inver Grove, Lakeville, Mahtomedi, New Prague, Orono, Prior Lake, Rosemount, Shakopee, St. Anthony, St. Francis (Isanti), Waconia.

Group 4 (Parochial: 1 -- 1,300 Secondary or Elementary Enrollment)
Hill High School, Incarnation, Nativity, Sacred Heart, St. Bernard's, St. Margaret's.

Group 5 (Very large: 8,001 or over Secondary Enrollment)
Minneapolis, Robbinsdale, St. Paul.

During the data collection phase of the study it became apparent that all of the school systems in Group 5 above were not going to be able to participate as heavily as other groups in any coordinated or cooperative project. Thus, the principal conclusions that are drawn in this report do not include the effect of these three schools.

The areas that were examined in connection with this study included exploration of potential data processing uses with persons having the following job titles or functional areas of responsibility:

A. Superintendents
B. Directors of Elementary Education
C. Directors of Secondary Education
D. Directors of Business Affairs
E. Elementary Principals
F. Secondary Principals
G. Curriculum Consultants
H. Teachers, Department Heads or Coordinators
    1. Mathematics
    2. Business Education
    3. Social Studies
    4. Science
I. Directors of Nursing
J. Guidance Counselors or Coordinators
K. Directors of Transportation
L. Purchasing Officials

M. Librarians

N. Directors of Audio Visual

In the data collection process, emphasis was placed upon (1) the nature of the in-service programs that would be necessary for proper development, implementation and improvement of data processing services; (2) how the application of data processing services to the various curricular areas might possibly achieve more coordination and mutual development in these areas; and (3) how data processing services might further improve the operations of the various functional areas of the school not involving curricula.

III. PROCEDURES USED IN PLANNING STUDY

A. Grant Application Plan.

The planning project was designed to be carried out by completing the following ten tasks as reprinted in part from the original grant application.

TASK 1 - Subcontract for performance of tasks three through ten.

The Suburban School Service Joint Board contracted with the ERDC for the performance of tasks three through ten.

TASK 2 - Formation of a data processing advisory committee.

This committee was formed to represent the public schools initiating this proposal, non-public schools in the Twin Cities metropolitan area, the College of Education, University of Minnesota, and the Minnesota State Department of Education. This committee was to serve in an advisory capacity to the planning staff in formulating the operational goals for coordinated data processing services, the operational requirements of the system to assure compatibility with current operation procedures and/or possible modifications of operating procedures to achieve defined goals, and to assist in establishing priorities of function implementation.

TASK 3 - Determination of operational requirements.

Representative categories of requirements that were considered in the planning project were those related to:

1. Instructional functions.
    a. Pupil instruction in computer mathematics and operation.
    b. Test scoring and analysis.
2. Professional personnel development function.
    a. Requirements of an in-service training program to enhance utilization of data processing services.
3. Administrative functions.
    a. Professional and non-professional personnel records.
    b. Transportation scheduling.
    c. School census.
4. Business office functions.
    a. Payroll.
    b. Budget.
    c. Inventory and capital facilities control.
5. Pupil personnel functions.
    a. Pupil records.
    b. Pupil scheduling.
    c. Grade reporting.
    d. Attendance.
    e. Test scoring and analysis.

TASK 4 - Review of existing and currently planned utilization of data processing by participating agencies.

A complete review of existing and currently planned applications of data processing by participating school districts was performed. The purpose was to compile information on applications in operation or planned within the structure of participating schools as well as those services now provided to schools by private service agencies.

An important objective in this task was to assess the degree of shift-over that would be required when individual school systems' applications are brought within the framework of coordinated services.

TASK 5 - Definition of system technical requirements.

The purpose here was to translate the operational requirements listed in Task 3 into technical requirements which would form the basis for the generation of systems concepts and equipment characteristics.

TASK 6 - Review and analysis of existing systems.

This task encompasses two activities. First, site visits to existing data processing systems serving schools. The second activity under this task involved the evaluation of available equipments or services which are candidates for satisfying the technical requirements of this project.

TASK 7 - Development of interim and final system concepts.

This task was intended to provide the configuration for the proposed system. It permits consideration and evaluation of alternate approaches and review of the requirements in the light of possible "trade-offs." The alternate system concepts arrived at were to be reviewed by the planning advisory committee as to operating characteristics, capabilities, limitations and costs. This would facilitate the selection of the preferred concept by the users.

TASK 8 - Establishment of functional specifications for equipment and software.

In Task 8, the functional specifications for equipment were to be established. The characteristics of each element of the total system will function as described in Task 7.

TASK 9 - Description of personnel training, operation, and maintenance.

Requirements:

1. Job descriptions for all personnel required to operate and service the system described in Task 6.
2. Training requirements for personnel of participating schools and agencies to insure maximum utilization of the system's capability.

TASK 10 - Establishment of detailed master plan for programming, budgeting, and implementing the coordinated data processing center.

The major effort of the planning proposal is culminated in this task with the establishment of program design, budget development, and implementation schedules for the establishment of a Coordinated Data Processing Center.

This master plan includes PERT or CPM networks showing the activities necessary to implement the facility, including scheduling and cost. The master plan shows when each step of design, procurement, installation and initial operation will take place to fulfill the operational requirements established in Task 3. This plan is an absolute essential so that using agencies can schedule their own applications consistent with switch-over potential of the facility to be established.

B. Execution of Plan.

1. Initial planning.

Following notification of receipt of the grant, project personnel set forth the detailed steps to successfully carry out the planning function.

2. Appointment of advisory committee.

The data processing advisory committee was appointed and included the following persons:

Mr. J. K. Haehlen, Supt.
Orono Public Schools
Long Lake, Minnesota

Mr. Jim Lindsay, Director
Data Processing
College of St. Thomas
St. Paul, Minnesota

Dr. Douglas Anderson
Dept. of Educ. Psychology
University of Minnesota
Minneapolis, Minnesota

Mr. Philip S. Taylor, Director
The Science Museum of the St. Paul
Institute
St. Paul, Minnesota

Mr. Edward Zeigler, Director
of Data Processing
3M Company
St. Paul, Minnesota

Mr. Andrew Eckert, Bus. Mgr.
Minneapolis Public Schools
Minneapolis, Minnesota

Dr. John Bicknell
Director of Research
Minn. State Dept. of Educ.
St. Paul, Minnesota

Brother E. Louis, Director
Hill Christian Brothers
High School
St. Paul, Minnesota

Dr. Fred Rohde, Asst. Supt.
White Bear Lake Public Schools
White Bear Lake, Minnesota

Brother Joseph de La Salle
St. Mary's College
Winona, Minnesota

Mr. James Henderson, Headmaster
Blake School
Hopkins, Minnesota

Mr. Robert Koenig
Director of Methods & Research
Super Valu, Inc.
Minneapolis, Minnesota

Mr. Milt Ojala, Director
Hopkins Modular Curriculum Project
Hopkins Public Schools
Hopkins, Minnesota

Mr. Tom Barrett, Director of Data Processing
Bemis Co.
Minneapolis, Minn.

Mr. James Scamman
Midwestern States Educational Information Project
Minn. State Dept. of Educ.
Minneapolis, Minnesota

Mr. Andrew Hobart, Pres.
St. Louis Park Board of Educ.
St. Louis Park, Minnesota

3. Interviews of selected school personnel.

Four schools were selected as being representative of the educational institutions to be served by the project. Data was to be collected in sufficient detail so that questionnaires for later distribution would have significant in-service value and not serve as data collection instruments only. Interviews were conducted in these schools during March and April with a view to determining their needs, problems, and the possible advantages of data processing services to them. The four schools -- three public and one parochial -- were: Bloomington High School, White Bear Lake High School, St. Anthony High School and Hill High School (Christian Brothers).

4. In-service activities.

During late April and early May, six in-service seminars were held for personnel from all school systems participating in the study. The seminars covered information requirements and needs in elementary and secondary pupil personnel, library, audio-visual, instruction, guidance and research, and health services. Over 300 school personnel participated in these one-half day seminars for the exchange of information.

In July, an in-service question/answer session was held to assist personnel from participating schools in considering the application of data processing to the areas of accounting, maintenance, purchasing, food service, transportation, census, and personnel records.

A special in-service seminar on the experiences of a present data processing user was scheduled for September 27. This session was offered for elementary and secondary school principals and focused on data processing applications of test scoring (standardized and teacher-prepared) and pupil attendance.

5. Questionnaires.

To give school personnel an indication of the possible applications of data processing to various phases of education, a series of twelve questionnaires were prepared by Broeker Hendrickson & Co. Each individual questionnaire dealt with a separate phase of potential applications to education and provided a detailed description of possible uses within the area covered by the questionnaire. Respondents were asked on the questionnaire to provide some general statistics as to the number of personnel, amount of time, and individual processes presently involved in performing certain functions. Following a written explanation of possible data processing services, the respondents were asked to benefit rate the various potential uses. This consisted of allocating 100 points to multiple services. Those services of larger benefit would receive a larger number of points than those of smaller benefit. In-service material constituted approximately 75% of the questionnaire content.

Questionnaires were mailed in three phases. The first phase included separate questionnaires dealing with the following areas: Guidance/ Research, Elementary Student Personnel, Secondary Student Personnel, Library, Audio-Visual, Health Services, and Instructional Uses.

The second phase included questionnaires dealing with these areas: Transportation, Census, Personnel Records, and Business Office Functions (e.g. appropriation and budgetary accounting, property records, accounts payable, payroll, requisition/inventory systems, purchasing, food service, activity fund accounting, etc.)

Following the return of the Phase I and Phase II questionnaires, a general summary questionnaire (Phase III) of the first two questionnaires was prepared and mailed to the superintendents of the school systems participating in this project. The superintendents were also asked to consider the possible applications of data processing to the schools in their district and, from an over-all point of view, to give benefit ratings to eleven general application areas.

6. Data reduction and analysis.

   Following return of each of the respective sets of questionnaires, the project staff conducted a reduction and an analysis of the data. Three tabulation and preliminary summary documents were published.

7. Commercial Data Center Contact.

   In August meetings were held with the representatives from the following firms currently providing data processing services to metropolitan area schools:

   Scientific Computers, Inc.
   Data Management, Inc.
   Service Bureau Corporation
   Control Data Corporation

8. Computer manufacturer contact.

As necessary, communications have occurred between project personnel and manufacturers representatives.

9. Other contact and consultation.

Members of the project staff visited the following locations providing data processing services to schools for consultive purposes during the course of the study:

New England Educational Data Systems (NEEDS)
Cambridge, Massachusetts

Oakland Intermediate School District
Data Center
Pontiac, Michigan

Board of Cooperative Educational Services
Buffalo, New York

Broward County, Florida

Dade County, Florida

Hillsborough County, Florida

Santa Clara Regional Center
California

Ventura Regional Center
California

Memphis Public Schools
Memphis, Tennessee

Iowa Educational Information Center
Iowa City, Iowa

Additionally, certain personnel visited project personnel to review and discuss this report and, where appropriate, carry out in-service activities.

In that connection, Mr. William English, from the educational data processing center at Broward County (Ft. Lauderdale), Florida, visited in September.

Also in September, Mr. Jack Totheroh, from the Ventura, California, Regional Educational Data Processing Center, met with the advisory committee and project personnel.

To make certain that the project properly took into account other data processing developments affecting schools in this state, project personnel met with representatives of the Information Systems Contractor at the Minnesota State Department of Education and with Dr. James Scamman of the Midwestern States Educational Information Project.

IV. ALTERNATIVES FOR PROVIDING DATA PROCESSING SERVICES

In the course of the study, several alternative means of providing data processing services to participating schools were examined. Meetings were held with personnel from both the Minneapolis and St. Paul School systems. Both systems presently have electronic computers and personnel providing data processing services to their internal organizations. Their interest in and capability to provide similar services to other metropolitan school systems was thoroughly discussed. Meetings were also held with three commercial data centers presently providing certain data processing services to school systems in the metropolitan area in order to determine their view of the role they might play in connection with the provision of cooperative data processing services for school systems. The principal alternatives examined are as follows:

Alternative A. - Coordination/Curriculum Development/In-service Education.

This approach would assume that each school system would be able to utilize whatever data processing resources it chose, such as commercial data centers, services offered by other school systems or their own on-premise equipment. A staff of two or three systems analysts could act as coordinators in connection with the independent activities of the school systems in order to provide the basis for certain coordination. The emphasis of the staff would be on development of uniform student and personnel identification systems, course numbering systems, classification systems and uniform data formats. They would also function as a clearing house so that the experience of certain school systems could be adequately communicated to others undertaking allied projects.

The systems analysts or other staff personnel could undertake the development of in-service programs that would be part of the development or implementation of new data processing services. Such an undertaking would, of course, require that a significant amount of uniformity exist with respect to the nature of a data processing service to be utilized by multiple schools and that their utilization of a particular service begin at approximately the same time.

A separate staff of two or more curriculum development specialists could be maintained as part of this alternative. Their function would be to undertake the development of a curriculum and appropriate materials in connection with certain instructional uses of data processing equipment. These persons would have an excellent background in the subject areas of their involvement, i.e., mathematics and business education, and would work closely with educational consultants and teachers from the participating school systems in order to develop the curriculum and in-service programs necessary for the orderly and appropriate introduction of the new or revised curriculums to the classroom environment. Additionally they would have to work closely with the systems analysts and programmers responsible for selection of hardware and development of computer programs appropriate to the curriculum.

Alternative B. - Systems & Programming Staff/Hourly Data Center/ Curriculum Development/In-service Education.

This approach would involve the recruitment of a substantial staff of systems analysts and programmers who would undertake the development and implementation of a wide range of data processing services for the participating schools. These services would be developed so that the systems design and programs adequately take into account the requirements of many diverse school systems and substantially meet the needs of all of them. This would not imply uniformity for many of the unique requirements of individual school systems could be met through creative design activity. However, certain standardization would obviously be necessary and desirable. The net result should be that a significant cost reduction would be effected through cooperative design and programming efforts as compared to each school system undertaking its own. Additionally, the data processing service would in all likelihood be more comprehensive and of a higher quality than those flowing from individual developmental efforts.

The hardware for provision of the data processing services in this alternative would be that belonging to a commercial data center or a computer manufacturer willing to rent operating personnel and/or computer time by the hour or some other reasonable time increment. This arrangement would have particular advantage if the mix of data processing services created a highly variable workload on a daily, weekly or monthly basis. Thus the project would not have to incur substantial on-premise hardware costs due to underutilized capacity.

In-Service Education & Curriculum Development activities would be nearly identical to those described in Alternative A above.

Alternative C. - Systems & Programming Staff/On-Premise Hardware/Curriculum Development/In-service Education.

This alternative is identical to B above except that the project would have its own data processing hardware on or near the premises occupied by the project systems and programming personnel. This alternative would have advantages in the sense of reduced travel time on the part of staff personnel, improved control over input/output quality, better control over processing schedules, and greater flexibility with respect to the types of hardware and software used in connection with the project. These advantages must be balanced against the higher hardware costs as compared to the hourly rental of data center time.

Alternative D. - Minneapolis/St. Paul Provision of Services.

As mentioned earlier, utilization of the above school systems, personnel, hardware and programs was seriously discussed. This approach would have the advantage of utilizing the experience and hardware already in existence and could have the effect of materially reducing the lead time and cost of providing data processing services to other school systems. Material increases would be required with respect to the systems, programming and operations staff. Additionally, hardware capabilities would also need to be increased. Curriculum development and in-service education activities would be undertaken in a fashion similar to that described in Alternative A above.

Alternative E. - Commercial Data Center Provision of Services.

This alternative would involve the utilization of the capabilities of one or more commercial data centers already providing data processing services to area school systems. Such a center would be responsible for providing a high quality staff of systems analysts, programmers and operational personnel so that data processing services would be of comparable quality and cost as those available from the other alternatives. Hardware would, of course, be provided by such a data center. Their personnel should also have responsibility for any in-service education programs connected with the provision of data processing services. It would also be very advantageous if such a data center would provide the appropriate personnel to develop curriculum and oversee the availability of appropriate software and hardware to support the curriculum.

V. PRINCIPAL FINDINGS FROM QUESTIONNAIRES

Questionnaires pertaining to twelve different major school areas were sent to forty-eight public and private school systems in the Twin Cities Metropolitan Area which were interested in this study. These questionnaires were intended to do three things: (1) gather certain information about the present systems and conditions in these schools; (2) describe certain data processing services that might be provided; and (3) obtain benefit ratings of potential data processing services.

In addition, superintendents of the participating schools were asked to rate each of the eleven different major school services on the basis of the relative benefit for their school systems if electronic data processing services were widely available to them.

Tabulation and summary of relevant data from each of the questionnaires were completed in three phases. Phase I questionnaires, which dealt with the areas of guidance and research, elementary student personnel, secondary student personnel, test scoring, library, audio-visual, health service, and instructional uses, were tabulated and summarized during the month of July, 1966. Relevant data from Phase II questionnaires, which was concerned with the census, transportation, business office, and personnel records, was tabulated and summarized during the month of August, 1966. The benefit rating of potential services in the superintendents' questionnaires (Phase III) was compiled during the first week of September, 1966. The tabulation and summarization of the relevant data from Phase I, II, and III questionnaires can be found in a separate document, though certain data is contained in the appendix of this report. The principal findings noted herein are the results of an analysis of these tabulations. The questionnaires should serve a valuable purpose in connection with any detailed systems design efforts.

In tabulating and analyzing the responses to these questionnaires, the participating schools were classified into one of five groups as follows:

Group	Secondary Enrollment
Group 1	Large (3,001-8,000)
Group 2	Medium (1,301-3,000)
Group 3	Small (1-1,300)
Group 4	Parochial (1-1,300)
Group 5	Very Large (8,001 or over)

In addition, analysis and tabulation was made for the total groups. Descriptions of the principal findings will generally pertain to the total groups except in special cases where outstanding discrepancies exist among groups. While the Minneapolis and St. Paul school systems completed the returned questionnaires, their data has not been included in the analysis below because it became apparent that their involvement in any cooperative data processing arrangement would be limited, particularly at the outset. The majority of questionnaires requested a benefit rating of potential data processing services for each school area. Specific reference will also be made to this.

A. Summary of Present Utilization of Automatic Data Processing.

During the course of this study, it was apparent, in our opinion, that most school systems had an exceedingly high level and enthusiastic interest in using or extending their use of data processing services. The Minneapolis and St. Paul school systems were already utilizing electronic computers. The Robbinsdale School system was utilizing punched card equipment and data center services for elements of the scheduling activities. No other schools in the study had punched card equipment or electronic computers on their premises. Many of the other schools, however, were making extensive use of commercial data center services, principally for secondary student scheduling and mark reporting. Below is a summary of the utilization of commercial data center services for those schools in the study. Excluding Minneapolis, St. Paul, Robbinsdale and the Catholic parochial schools (excepting the six that participated in the study), the total student population of the school systems participating in the study is (1) K - 6 grade/129,768; (2) 7 - 12 grade/89,957. Total student population is 219,725. Total certified personnel were 9,601 and 3,763 non-certified personnel for a total personnel count of 13,364. The Catholic parochial school population in the metropolitan area is (1) 1 - 8 grade/58,008; (2) 9 - 12 grade/13,458. Total student population is 71,458. While data are variable, it appears that non-public school utilization of data processing services is not higher than that of the public schools.

1. Scheduling/Mark Reporting.

   Presently approximately 41,000 secondary students are covered by scheduling and/or mark reporting services provided by commercial data centers. Twenty school systems out of 45 are utilizing these services. Many of the school systems indicated that substantial improvements were needed in the quality and scope of those services presently being provided.

2. Census.

   Presently five school systems out of the 45, or approximately 11%, are utilizing commercial data centers in this connection.

3. Payroll.

   Presently fewer than five school systems are utilizing data center services in this connection.

4. Central Stores Inventory.

   At least one school out of 45 is utilizing this data center service.

5. Appropriation and Budgetary Accounting.

   Presently at least one school out of 45 is utilizing this service.

6. Test Scoring/Analysis.

   While many of the standardized tests are machine scored by the publisher, a large number of standardized tests are hand scored. None of the 45 schools are machine scoring their standardized tests nor are any teacher-prepared tests being machine scored.

7. Instructional Uses in Mathematics.

Presently some 9% of all the secondary mathematics teachers are utilizing computers in connection with their classroom or student co-curricular activities. Approximately 21% of all teachers were considered qualified by the respondents to undertake the above-mentioned activities.

8. Instructional Uses in Business Education.

Approximately 18% of the school systems had a key punch installed for business education purposes. Some 23% of the schools had courses devoted to teaching principles and uses of punched card equipment. About 7% of the schools had a separate course or devoted a portion of present curricula to computer programming.

No other uses than the above were indicated by the schools in connection with this study.

B. Guidance and Research.

The most important item of the guidance and research questionnaire is the benefit rating of potential data processing services (note page 8 in appendix). Participating schools were asked to allocate one hundred benefit points among seventeen potential services.

The ten applications of data processing for guidance and research most desired by all groups on the basis of total gross points in rank order from one to ten are: follow-up studies, scoring and analysis of standardized tests, group counseling identification, withdrawal studies and detection, analysis of special students, over/under achievement analysis and detection, post high school education index, student profile-6th grade, standardized test analysis, and analysis of post high school education/vocations selections.

On comparing individual groups to the total group the benefit rankings are very similar. However, there is one notable exception to this. Although group counseling identification ranks third for the total groups, it ranks eleventh for the large schools (3,001-8,000) and ninth for the medium schools (1,301-3,000). Obviously, the ranking of the parochial schools based on 135 gross points has offset the ranking for the total group. In other words, the large and medium size public schools of the metropolitan area do not feel that the use of data processing for identifying students with similar characteristics or interests for group counseling sessions is at this time one of the priority services. The parochial schools, however, consider this as very important.

Further analysis of the benefit rating table in relation to the other selected items from the guidance and research questionnaire indicate such things as:

1. Guidance personnel see electronic data processing as an important potential service for follow-up studies. Most definitely plan on some periodic follow-up studies of each class in the larger schools, but it does appear that the extent of data collection and analysis will be impaired without data processing services. However, 65% of the total group feel that their past follow-up findings have not resulted in significant changes in their educational programs. Obviously, careful attention must be given to action resulting from this data or provision of any data processing service is hardly worthwhile.
2. For a large percentage (61%) of the schools, dropout studies are not being done annually and when they have been done, a large percentage (85%) say they have not been able to translate the data that resulted from the dropout studies into action that has altered the dropout pattern. Indications are that electronic data processing would help guidance personnel in earlier detection of possible dropouts which would hopefully help school personnel in altering the dropout pattern.
3. Over half of the forty-three schools (58%) do not at present circulate to all their secondary teachers

a list of standardized test scores, and when standardized test scores are given to teachers they often have to recopy them onto another record. No doubt EDP services would improve this condition.

The results obtained from these few selected items definitely indicate that electronic data processing service would be valuable for guidance and research.

C. Elementary Student Personnel.

Twenty potential data processing services were described in the elementary student personnel questionnaire. Respondents were asked to indicate the relative benefit of each in a three step process. First, they were to rate the twenty potential services so a ranking could be made on the basis of gross points. Second, they were to allocate 100 points between two potential testing services, namely: test scoring of standardized tests and test scoring of teacher-prepared tests. Third, they were to allocate 100 points between elementary student personnel and test scoring.

The ten applications of data processing most desired by all groups on the basis of total gross points in rank order from one to ten are: annual attendance report, periodic attendance accumulation, machine scoring of standardized tests, class lists, scheduling of teacher-parent conferences, kindergarten roundup mailing, family/student directory locater file, bus routing, boundary-line determination, and student/family information and background (note page 9 in appendix).

Further analysis of the benefit rating scale in relation to other selected items from the elementary student personnel questionnaire indicate such things as:

1. High rankings for the need of data processing in annual and periodic attendance accumulation and reporting are in part due to the fact that in 30 per cent of the schools, teachers are still responsible for keeping daily attendance data and much time is required when personnel in the principal's office have responsibility for this task.
2. A relatively high ranking (9th place) for data processing in boundary-line determination is due to the fact that at present the time devoted to such a task is rather extensive. The table on "Time Spread from the 'Beginning Data Collection' date to the 'Completion of Boundary Line Determination' date" shows that it takes one-third of the schools over 3-1/2 months to complete this task. Only 24 per cent of the schools can complete this task in one month or less. Moreover, several persons responsible for this task indicated that manipulation of the data, once collected, is very difficult and does not permit them to make projections beyond the current year. The effect of this is that often children are assigned to different buildings in consecutive years unnecessarily.

3. Although machine scoring of standardized tests ranks third in the total elementary student personnel services, test scoring (including standardized test scoring and teacher-prepared test scoring) ranks second in relation to elementary student personnel services in general. In other words, since test scoring has been, and could continue to be, provided by testing companies or other agencies, it is secondary when considering all the other elementary student personnel services which could benefit by data processing. In addition, data processing for the test scoring of standardized tests is considered more important than for the test scoring of teacher-prepared tests.

D. Secondary Student Personnel.

In tabulating and analyzing the responses to the secondary student personnel questionnaire, instead of using the "group classification" the following classifications were used:

Junior Highs (7-9)	Jr.-Sr. Highs (7-12)
*Senior Highs (10-12)	Total Secondary (7-9, 10-12, 7-12)

*This includes five schools which have 9-12 classes.

Benefit rating tables were constructed for junior highs (7-9), senior highs (10-12, 7-12, and 9-12), and total secondary (junior and senior highs). These tables (note pages 10, 11 and 12 in appendix) vary in the benefit ratings of some potential services.

The ten applications of data processing most desired by junior highs are, in rank order: student sectioning/schedules, mark (grade) reports, annual attendance reports, class list, mark label for cumulative records, teacher mark distribution, failure and incomplete list, honor roll list, periodic attendance accumulation, and course tally. The ten applications most desired by senior highs (10-12, 7-12, and 9-12) are in rank order: student sectioning/schedules, mark (grade) reports, conflict matrix, class lists, class rankings, course tally, annual attendance reports, failure and incomplete list, honor roll list, and mark label for cumulative records.

The ten applications of data processing most desired by total secondary (both junior and senior highs) in rank order from one to ten are: student sectioning/schedules, mark (grade) reports, annual attendance reports, class lists, conflict matrix, mark label for cumulative records, course tally, failure and incomplete list, honor roll list, and teacher mark distribution.

Other principal findings in relation to the benefit rating scales are:

1. An electronic student record properly developed and implemented is highly desired and considered beneficial by 90 per cent of the schools in the study.
2. Over half (54%) of the schools have not completed their registrations by March 1 of the school year.

3. Over half (55%) of the schools have not completed their master schedules by May 15 of the school year.
4. Over half (62%) of the schools have not completed their sectioning of students by June 15 of the school year or by the close of the school year.
5. In relation to the above facts regarding registration, master schedules, and sectioning of students, it is easy to see why data processing is desired for student sectioning and schedules (ranks first) and conflict matrix (ranks fifth). However, successful use of data processing services of this type will require schools to observe stricter and early schedules in this area.
6. At all levels of the secondary school, data processing is considered more important for total secondary student personnel service than for test scoring of teacher-prepared tests. (Note page 13 in the appendix.)

E. Library.

The five data processing services most desired (note pages 14 and 15 in appendix) by elementary librarians in rank order are: book processing, union catalogue, reading pattern inventory, student/class profile and circulation control.

The five applications of data processing most desired by secondary librarians in rank order are: book processing, union catalogue, circulation control, student/class profile, and reading pattern inventory.

The five applications of data processing most desired by combined elementary and secondary librarians are: book processing, union catalogue, reading pattern inventory, student/class profile, and circulation control.

Other significant findings are:

1. Book processing and union catalogue rank first and second, respectively, for both elementary and secondary.
2. Elementary librarians consider a reading pattern inventory more important than circulation control, while secondary librarians consider circulation control more of a need than a reading pattern inventory.
3. A student/class profile is considered of fourth ranking importance for both elementary and secondary librarians.

Other findings from the library questionnaire responses are:

1. Sixty-seven per cent of the elementary schools have central ordering and processing for all elementary books, while 50% of the secondary schools have central ordering and processing for all secondary books. With this centralization, data processing is desired (ranks first) for book processing.
2. Regarding library personnel, 14% of the schools responding had a district head librarian, 35% had

a head secondary librarian, 34% had a head elementary librarian, and 17% had none of these positions in their system.

3. Other potential uses suggested by librarians were: information retrieval, formation of bibliographies or reading lists, mechanized microfilm printers and readers, and selection aid searching.

F. Audio-Visual.

The five data processing services most desired (see page 16 in appendix) for audio-visual in rank order are: materials catalogue, equipment property records, equipment maintenance records, catalogue of resource personnel and catalogue of field trips. In addition, respondents considered central ordering, booking of films, and information retrieval desirable applications.

Other findings are as follows:

1. Only 49 per cent of the forty-five respondent schools presently have a printed catalogue of all films, records, tapes and other materials.
2. Of this 49 per cent (22 schools), only 12 publish a new catalogue edition annually, 6 publish semi-annually, and the rest publish every three to five years. Ten of the twenty-two schools which presently have printed catalogues, publish one supplement annually while the remaining twelve publish from two to five supplements annually.

3. Over three-fourths of the schools (76%) do not integrate their films, records, tapes, and other materials into their existing curriculum guides so that a convenient list is available within each unit of the guide.
4. Thirty-one of the forty-five responding schools (69%) have a central ordering process for all audio-visual materials.
5. Only 44 per cent of the schools surveyed maintain utilization records on most equipment that is scheduled through audio-visual. Of those schools which do not maintain such utilization records, 44 per cent feel this type of data would be helpful in knowing when to schedule preventive maintenance and projecting replacements.
6. Over two-thirds of the schools (69%) keep records of maintenance frequency and costs for audio-visual equipment.

G. Health Service.

The four data processing services for health service most desired (note page 17 in appendix) by all the groups in rank order from one to four are: permanent health records, immunization and test processing, ear, eye, and dental examinations and state reports.

Responses to other questions reflect upon this total group benefit rating in that:

1. Immunization and test processing is a big business when you note that during the school year 1965-66, these forty-three schools have 83,911 immunizations and 70,547 tuberculin tests. Data processing could be of material assistance in this area.
2. Elementary and secondary school nurses spend much time in clerical work:
    a. Sixty-seven per cent of the school nurses are responsible for comparing the returned health and emergency information document with the original health card.
    b. Seventy-one per cent of the school nurses are responsible for posting ear, eye, and dental examinations to the permanent health record.
    c. Seventy-one per cent of the school nurses are responsible for posting the students' health card with respect to the completion of immunizations or tests.
3. Other potential data processing services mentioned in the area of health were recording of accident reports, physical education excuses, athletic physicals, and referrals to other services. Data processing could also be used in the supply and inventory process.

H. Instructional Uses.

Out of discussions held with instructional personnel in the four pilot schools came a conclusion that the availability of certain data processing services might be beneficial to several curriculum areas but specifically to mathematics, science, social studies, and business education. Consequently, potentials for data processing for these four specific curriculum areas were surveyed. Significant findings are as follows:

1. Mathematics.
    a. Sixty-eight per cent of the schools surveyed believed that resources should be directed toward the integration of computer mathematics into existing subjects or units rather than to the development of separate or new courses.
    b. Eighty-six per cent of the schools surveyed felt that the Educational Research and Development Council should sponsor the development of such a computer mathematics curriculum.
    c. Two-thirds of the schools surveyed (66%) felt that the emphasis on curriculum development such as this should be detailed units rather than on broad curriculum outlines.
    d. Ninety-three per cent of the schools surveyed felt that an in-service education program should be developed by the Educational Research and Development Council to acquaint present mathematics teachers with this curriculum.

e. Ninety-six per cent of the schools surveyed felt that the availability of a computer and appropriate programs would be of benefit to selected students for participation in independent projects.

f. Of the 559 secondary mathematics teachers in the school districts surveyed, only 48 (9%) had classes or activity programs in writing and running computer programs. However, 119 secondary mathematics teachers (21% of the total secondary mathematics teachers) had sufficient course work to introduce computers into their curriculum in the opinion of the respondents.

g. Of the 41,040 students in the secondary schools surveyed, only 2,118 students (5%) were presently participating in classes or activity programs wherein students are writing and running computer programs. Almost 60% of these students in such programs are found in the Group 1 schools (Large-3,000-8,000 Secondary Enrollment).

2. Science.

a. Concerning the value of a computer as a teaching aid in six areas of biology the following was found:

(1) Over four-fifths of the science teachers responding to the questionnaire felt that a computer would be valuable in the biology areas of population growth, microbe colonies, and patterns of life.

(2) Over one-half of the science teachers responding to the questionnaire felt that a computer as a teaching aid would be valuable in the areas of seed germination, dichotomous keys, and temperature or rainfall calculations.

b. The value of a computer as a teaching aid for physics and chemistry was also measured with similar results indicating its usefulness.

c. Seventy-seven per cent of the science teachers could see benefit in introducing the computer to a general science course so that students have a general idea of computer characteristics and components as well as examples of certain modern day applications of computers in science. However, only 57% of these teachers could visualize certain specific types of mathematical problems that students might beneficially solve in a general science course by utilizing a computer.

d. Seventy-three per cent of the science teachers responding felt that there are likely to be a significant number of students in honor programs or with special independent projects that would benefit by the availability of a computer for data reduction, analysis, or problem solving. However, only 54% of the science teachers responding felt that a computer would be useful as a tool to help certain students who have difficulty with mathematical problems in science courses.

e. Four-fifths of the schools surveyed felt the Educational Research and Development Council should sponsor the exploration of computer uses in science curriculum by a group of local science teachers and resource persons for purposes of developing an appropriate curriculum. And if this is done, then 82% of the schools surveyed feel that ERDC should sponsor the development and execution of an in-service education program designed to acquaint science teachers with this developed curriculum.

3. Social Studies.

a. All of the schools surveyed felt that there would be at least a moderate value in developing some curriculum concepts and materials designed to illustrate the impact of computers on modern society.

b. Ninety-one per cent of the schools surveyed felt that it would be desirable for the Educational Research and Development Council to sponsor an effort by local social studies teachers and other resource persons to develop concepts and materials relating to computers and their social impact that might be incorporated into social studies curriculum.

c. Assuming that such a curriculum is developed, 93% of the schools surveyed felt that ERDC should sponsor in-service education programs to acquaint teachers with the curriculum and materials.

d. Over four-fifths of the schools surveyed felt that the availability of a computer for students having certain independent projects or honor programs would be useful.

4. Business Education.

a. At present only eight of the schools surveyed (18% of the total group) have a keypunch installed within their schools for business education purposes. Generally, the keypunch is not used in connection with a separate course but is integral with another course. In an average year, approximately 632 students within the eight schools are enrolled in this type of course. For such a course, over half of the respondents felt that it would be helpful if ERDC sponsored the development of improved curriculum and materials as well as an in-service education program for teachers.

b. Only 23% of the schools surveyed presently have a course devoted to teaching the principles and uses of punched card or tabulating equipment. These current courses serve on the average 584 students annually. An average of 38 hours of school time are devoted to these courses with a range from ten to one hundred fifty hours. When these courses incorporate instruction on computer programming, on the average they devote only 14 hours to it (with a range within the four schools offering this of five to forty hours). Over half (59%) of the schools not having such a course believe that such a course would serve a real need in their school systems, and over four-fifths (84%) of the schools surveyed feel it would be beneficial for ERDC to sponsor the development of curriculum, materials, and a teacher in-service education program for such a course.

c. Only one school reported having a separate course in computer programming at present, although fifty per cent of the schools surveyed (22 schools) feel there is a need for such a course. Seventy-seven per cent of the schools surveyed favor the development of curriculum, materials, and in-service education programs along this line under the sponsorship of the Educational Research and Development Council.

I. Census.

1. At the present time, 79% of the school systems do not use data processing in connection with census. Twelve per cent use data processing for census and nine per cent plan to use it by September, 1968.
2. Four hundred thirty-five enumerators are used in the census process in the forty-two schools surveyed. In other words, on the average, ten enumerators are used for the census. Within the forty-two schools, half of the enumerators are housewives and a third are teachers. A very small per cent use administrators for census data gathering.
3. It is estimated that 951 annual man days are involved in tabulating and checking the census data once

collected by the enumerators within these forty-two schools. This means on the average that 23 annual man days are involved in this tabulating and checking process per school.

J. Transportation.

(Transportation -- Phase II)

1. School personnel were asked to indicate the relative benefit (note page 18 in appendix) of four data processing services possible in transportation. These four applications of data processing services most desired by the total group of schools surveyed in rank order from one to four are: bus routing, transportation reports, bus maintenance, and bus passes. Other applications mentioned by school personnel are: extra-curricular mileage records, accident and insurance reports, and student passenger lists.
2. Currently, 467 buses are owned by the 42 school districts while they lease or contract 620 buses. These districts employ 484 bus drivers. Three hundred twelve of these drivers also hold other responsibilities or positions in the districts, mainly custodial, maintenance or mechanical responsibilities.

K. Business Office.

1. Business office personnel were asked to rank twelve potential services according to the benefit (note page 19 in appendix) they would have for their districts. The ranking from one to twelve for the forty-two schools responding were as follows: payroll, accounts payable, appropriation and budgetary control, maintenance cost accounting, activity fund accounting, purchasing, inventory control, property records, textbook inventory, food service cost accounting, preventative maintenance scheduling, food service-perpetual inventory. Other potential data processing services recommended by school personnel were departmental instruction cost accounting, insurance accounting, contract accounting, and transportation cost accounting by bus.
2. Sixty-nine per cent of the school districts prepare one large batch of accounts payable checks per month while 21 per cent prepare large batches twice a month.
3. Only half of the schools (48%) surveyed either have an encumbrance accounting system or plan to utilize one within the next two years.
4. Although four-fifths (83%) of the school personnel surveyed see a benefit to distributing costs according to building or function, only one-fifth (19%)

of the schools distribute personnel costs and accounts payable expenses according to building.

5. Currently, within the forty-two schools surveyed 10,591 certified personnel, 4,175 non-certified personnel, and 791 full-time maintenance workers are employed.
6. Forty-six per cent of the schools surveyed maintain or plan to maintain within the next two years a central store of supply items. Of the nineteen schools having or planning to have a central store, nine estimate they have or will have contained therein less than 500 items; two estimate from 751 to 1,000 items; one estimates 1,001-1,250 items; one estimates 1,251-1,500 items; and four estimate more than 1,500 items. Two of these nineteen schools did not indicate an estimated number of items.

L. Personnel Records.

1. Opinions regarding the potential data processing service of a single master record for each staff member varied, with the smaller schools not seeing this as a need for them and the larger schools generally praising such a venture.
2. In 69 per cent of the forty-two schools surveyed, personnel records relating to certified personnel are conveniently available to building principals.
3. The three most time-consuming and repetitive tasks that are associated with the maintenance of personnel

records according to the forty-two schools surveyed are: (1) analysis of credits earned and placement on salary schedule; (2) posting and file maintenance activities, namely: credentials for new personnel, recording teacher programs and posting data on records; and (3) preparation of state reports -- teacher qualifications and certification.

M. Superintendents' Questionnaire. (Phase III)

After the questionnaires pertaining to the twelve major school services had been completed by various school personnel, superintendents of each district partaking in the planning study were asked to rate each of these twelve potential data processing services on the basis of the relative benefit for their school districts.

In rank order from one to twelve, data processing was considered most beneficial (note page 20 in appendix) and was most desired by the forty-two superintendents responding in the areas of: (1) business office, (2) secondary student personnel, (3) instructional uses, (4) guidance and research, (5) personnel records, (6) elementary student personnel, (7) test scoring, (8) census, (9) library, (10) transportation, (11) health service, and (12) audio-visual.

It was also suggested that data processing might be used with secondary master scheduling and athletic records. These suggestions came under "other suggestions" which ranked thirteenth.

VI. PRINCIPAL CONCLUSIONS AND RECOMMENDATIONS

A. Minimum Requisites for Starting.

We recommend that school systems with a combined student population of 100,000 (K-12) should indicate their interest to fully participate in the cooperative data center recommended in this report, prior to submission of an operational grant application to the United States Office of Education in Washington, D.C. on January 15, 1967.

B. Scope of Services.

We recommend that the long term objectives of a cooperative data center should include the offering of data processing services in each of the following areas:

1. Student Information System.
2. Administrative/Financial Information System.
3. Materials Information System.
4. Instructional Uses.

The data center should also take a leadership role in investigating microfilm or other image storage techniques for the handling of present and future school records.

This report also recommends that certain staff consultants should be part of the cooperative data center personnel complement. Their availability would be a fundamental element of the services to be provided to schools. Without them the Instructional Uses will make little progress. The personnel are as follows:

1. Educational Research Consultant.

   Responsibility - Contributes to the design of the Student Information System so that significant educational research can flow from it and to design and execute various suitable educational research projects with special emphasis on implementation of the findings.

2. Mathematics Consultant.

   Responsibility - Develop and implement in conjunction with mathematics personnel from the participating school systems a plan for integration into existing curricula of appropriate computer uses including in-service education, curriculum, materials, hardware and software.

3. Business Education Consultant.

   Responsibility - Develop and implement in conjunction with business education personnel from the participating school systems a plan for new or revision of present curriculum to include on a broader basis the subjects of (1) keypunch instruction (2) punched card data processing (3) computer programming. Such a plan would provide for in-service education, curriculum, materials, hardware and software.

4. Materials Information System Consultant.

   Responsibility - Develop in conjunction with library and audio-visual personnel from participating school systems a plan for utilizing modern technology for storage and retrieval of materials and information and to utilize the then present data center capabilities for various applications examined as part of this study.

5. Advanced Computer Related Instruction Consultant.

   Responsibility - Develop concepts and plans in conjunction with personnel from the participating school systems for the orderly utilization of advanced techniques for computer related instruction (CRI).

6. Social Studies Consultant.

   Responsibility - Develop and implement in conjunction with personnel from participating school systems a plan for integration into existing curriculum the significance of computer technology to the social, economic and political structures of our society. To provide for in-service education, curriculum, materials, hardware and software appropriate to the plan.

7. Science Consultant.

   Responsibility - Develop and implement in conjunction with personnel from participating school systems a plan for integration into existing curricula of appropriate computer uses including in-service education, curriculum, materials, hardware, and software appropriate to the plan.

C. Offering Dates of Initial Services.

We recommend that selected Student Information sub-systems be offered in the fall of 1968 (FY 69) as follows:

1. Attendance.
2. Scheduling.
3. Mark Reporting.
4. Guidance.

The initial Administrative/Financial Information sub-system should be the Employee Information sub-system to be available by July 1, 1968.

The initial Instructional Uses should be Test Scoring/Analysis beginning the fall of 1969. On a pilot basis, uses in connection with Mathematics and Business Education should be offered in fiscal 1969. However, many of the staff consultants described earlier in this chapter would be available to school personnel during fiscal 1968.

The offering of the above services on the dates specified is contingent upon beginning systems design activity in March of 1967. Delays beyond that date would likely result in deferring the offering of most of the data processing services by approximately one year.

D. Recommended Alternative.

It is recommended that ERDC, a joint board or a separate corporation under the control of the participating school systems be formed and that Alternative C, Systems and Programming Staff/On-Premise Hardware/Curriculum Development/

In-service Education be implemented. Alternative B, utilizing hourly data center time, is acceptable if satisfactory arrangements can be made for subsequent use of on-premise hardware. Below is our evaluation of the various alternatives.

Alternative A. Coordination/Curriculum Development/In-Service Education is not considered satisfactory because it would be extremely difficult if not impossible to carry out a coordinating activity in any meaningful way. Individual school systems with their own systems and programming personnel would often have ideas in conflict with over-all coordination objectives. Meaningful development of compatible information would probably require legislation or administrative ruling that might be several years forthcoming. Achievement of adequate coordination would also be imparied because different school systems would be at various stages of development and independent staffs of systems and programming people would not be prone to delay certain planning activities for weeks or months so that other school systems could catch up.

Alternative B. Systems & Programming Staff/Hourly Data Center/Curriculum Development/In-service Education has considerable merit and could be the initial course of action providing a suitable arrangement can be worked out with a commercial data center or equipment manufacturer. Any such arrangement should be of a nature that the programs developed for the hardware at the data center are adequately compatible with hardware that the cooperating schools would install for their own use at a later time. If those arrangements cannot be worked out, then Alternative C below should be implemented.

Alternative C. Systems & Programming Staff/On-Premise Hardware/Curriculum Development/In-Service Education is the alternative we recommend. If hourly data center time can be purchased for one year (Alternative B), that may be satisfactory. C should be the most effective and comprehensive of all alternatives. Curriculum development must be closely coordinated with systems design and programming efforts that necessarily accompany it. In-service education accompanying the introduction of curriculum would also involve close liaison between the curriculum and systems/programming specialists. The above can best be accomplished if they are functioning under and within the control of a single organizational entity.

In-service education in connection with introduction of non-instructional uses of data processing is of the utmost importance and can best be accomplished by those personnel having systems and programming responsibilities or their designates. Such in-service programs are likely to be of a much higher quality and of a more comprehensive character if the personnel are under the direct control of the participating school systems.

The various data processing services that could be made available to the school systems will always be subject to redesign and new services will be continually in a state of development. Utilization of a commercial data center to provide systems, programming, in-service education and operational services could create substantial complexities with respect to clear division of labor and responsibility and agreement on financial arrangement. As a consequence, the school systems would have less flexibility with respect to modification of services in the operational or planning stage.

Hardware that might be used in connection with a cooperative effort among the schools would be undergoing modifications from time to time in order to handle growth and take advantage of new technology. The alternative under discussion would provide the best flexibility with respect to utilizing hardware improvements with minimum delay.

Alternative D. Minneapolis/St. Paul Provision of Services is not a reasonable possibility at the present time. Both school systems have indicated that they are not in a position to provide data processing services to other schools in the metropolitan area though they would like to maintain close coordination with systems design and programming effort that might be undertaken in a cooperative effort.

Alternative E. Commercial Data Center Provision of Services/ Curriculum Development/In-Service Education does not appear to be a satisfactory alternative as of the date of this report. Meetings have been held with Data Management Inc., Service Bureau Corporation, Scientific Computers and the Data Centers Division of Control Data Corporation. All have expressed in writing their desire to participate in an operational project. However, we believe the participating schools are likely to obtain more satisfactory results through Alternative C.

Three of the above firms are providing scheduling and mark reporting services to approximately 41,000 secondary students in the metropolitan area. Several school systems utilizing these services indicated to us that they have not been pleased with the quality. School personnel indicated that adequate in-service programs have usually been absent whenever the services have been introduced.

None of the above data centers have a capability or interest in curriculum development. They would, of course, be able to provide systems and programming personnel that could work with the curriculum development personnel under the control of the participating schools. However, this is not as satisfactory an arrangement as when all personnel are under the control of the participating schools.

None of the above commercial data centers have offered test scoring and analysis services in the past. None has appropriate optical scanning equipment installed or on order to undertake this activity.

The largest justification for utilizing a commercial data center would, of course, be the opportunity to materially reduce costs to the school systems. In our opinion, personnel and facility costs would be no less for comparable personnel whether on a staff controlled by the participating schools or on the staff of a commercial data center. Theoretically, a commercial data center should be able to provide lower hardware costs through greater utilization of available hardware time. In this instance, their advantage in the above connection is reduced somewhat by the fact of educational discounts in the area of 25% that many of the computer manufacturers grant on their hardware.

In the event that conditions should change and indicate some advantage in adopting Alternative E, comprehensive proposals could be obtained from interested commercial data centers once that a sufficient number of school systems had agreed to join the cooperative program.

E. Staff Personnel Characteristics.

We believe it is of the utmost importance to select personnel for all capacities in connection with this project who are of substantially above average capability with respect to their particular specialization. While this philosophy contributes to higher personnel costs, we firmly believe that uniform adherence to this policy will materially improve the quality and early availability of various services as compared to conditions likely to prevail with lower standards for personnel.

It is also of the utmost importance that no fewer than 35% of the personnel recruited have a minimum of 1 or 2 years in which they were connected with the educational environment, preferably secondary or elementary. All other personnel recruited for the project should have prior experience so that several different types of organizational backgrounds are reflected in the staff.

F. Hardware/Software Characteristics.

1. Hardware. We recommend that the initial hardware configuration be of an off-line variety. We do not believe that Instructional Uses of this hardware in connection with Mathematics or Business Education will be sufficiently detailed for at least 12 months from the writing of this report and that other hardware resources should be initially utilized in this connection. However, any Instructional Uses that can be served by an off-line configuration should be planned. Time sharing requirements should be initially handled by utilizing the hardware resources available in this community from Pillsbury, ComShare, Control Data Corporation, Univac, IBM or others that may be satisfactory.

We believe that the Student Information System should be designed for utilization of magnetic tape for permanent record storage. This same approach should also be utilized with respect to the Employee

Information Sub-system. However, the offering of the Accounts Payable and Budgetary and Appropriation Accounting Sub-systems in fiscal 1970 should be oriented to direct or random access memory systems for memory storage. Further, a communication capability should be added to the central computer hardware at that time so that inquiries can be easily handled with respect to account balance and allied data. It does not appear that the Appropriation and Budgetary Accounting sub-system can function adequately under the decentralized budgeting system discussed later in this report without such an inquiry capability.

2. Software. The school systems that initially join the program will determine whether the hardware characteristics need to be escalated in order to handle certain types of Scheduling programs that are or may be available. It may be advantageous to utilize off-premise and larger computer hardware for this application in the event that is economically or otherwise advantageous. The specifications included in this report do not take into account any requirement for master schedule building software. The requirements for modular scheduling will have to be taken into account at the time that the initial participants in the cooperative program are determined.

G. Expenses and Financing.

1. Forecasted expenses as summarized from Schedule 2 in Chapter XIII are exclusive of member on-premise expenses:

Item	Fiscal Year (Thousands Omitted)					
	1967	1958	1969	1970	1971	1972
Personnel	40	266	418	525	543	584
Hardware	-	35	133	175	198	235
Other	34	143	195	206	205	236
Total Expenses	74	444	746	906	946	1,055

2. Membership Dues and Philosophy. This report recommends the use of dues based upon school enrollments to provide for the expenses of this project. However, expenses would exceed dues by approximately $952,000 in fiscal years 1968, 69 and 70. We assume Title III of P.L. 89-10 would be a possible source of funds in that connection. The schedule of forecasted dues income as summarized from Schedule 1 in Chapter XIII follow:

Fiscal Year (Thousands Omitted)					
1967	1968	1969	1970	1971	1972
$ 83	$143	$405	$605	$965	$1,080

Membership dues are recommended as the most appropriate means of financing for a project of this type, particularly at the outset.

The report also recommends that any new member pay backdues or a prorata share of development costs as determined by the governing body.

Because of significant differences in the data processing requirements of non-public schools, a separate dues schedule is recommended for them. The proposed annual per pupil dues escalate from fiscal 1967 to 1972 as follows:

Public Schools (K-12)	$.75 to $5.00
Non-Public (1-8)	.27 to 1.80
Non-Public (9-12)	.73 to 4.85

The report also recommends that the dues be at a level so as to finance several different types of activities not usually associated with commercial data center services i.e., curriculum development, in-service education, transportation, education research, etc.

3. Size of Membership. Dues assume a membership of 205,000 (K-12) public students by fiscal 1972. Non-public membership would be in addition. Membership must grow at an even rate to that size or dues will have to be increased. More rapid growth in membership than forecast may permit some reduction in the suggested dues schedule.

4. Member On-Premise Expenses. Certain expenses beyond the membership dues will have to be borne by member schools. These expenses will generally fall in the following categories:

1. Education Information System coordinator
2. Keypunch and control personnel
3. Equipment
4. Overhead
5. One time

Chapter XII contains additional details and expense schedules in this connection.

VII. PRIORITIES FOR OFFERING SERVICES

Several factors were taken into account in establishing a sensible approach to design, programming and implementation of various systems, sub-systems and applications. They include at least the following:

1. Receptivity of the potential users to the data processing services intended for offering.
2. Certain services must precede others by reason of foundation data that Service A must supply Service B under operating conditions.
3. Certain sub-systems or applications should be designed concurrently so that proper interface can be developed between two or more of them.
4. Certain of the data processing services would have more benefit than others in the opinion of school personnel or consultants to the project.
5. Selection of priorities with respect to the design function may be wholly independent of the sequence of implementation.

A. Principal Systems and Priorities.

The principal systems and sub-systems in an Educational Information system as defined in this planning study are as follows:

1. Student Information System.
    a. Census/Elementary Information Sub-System.
    b. Attendance Sub-System.

    c. Scheduling Sub-System.
    d. Mark Reporting Sub-System.
    e. Guidance Sub-System.
    f. Health Sub-System.
2. Materials Information System.
    a. Library Sub-System.
    b. Audio-visual Sub-System.
3. Administrative/Financial Information System.
    a. Employee Information Sub-System.
    b. Accounts Payable Sub-System.
    c. Appropriation and Budgetary Sub-System.
    d. Property Sub-System.
    e. Purchasing/Inventory Sub-System.
    f. Transportation Sub-System.
    g. Maintenance Sub-System.
    h. Food Service Sub-System.
4. Instructional Use System.
    a. Test Scoring.
    b. Mathematics.
    c. Business Education.
    d. Science.
    e. Social Studies.

Limited resources do not, of course, permit simultaneous design and implementation of all systems. Thus, we have set forth below a schedule for the initial systems design, programming and implementation of the various systems and sub-systems. Obviously, implementation for several schools will take several years. It should also be understood that while the systems design activity for a sub-system application might occur very early, not all of those applications within a sub-system would be implemented initially. In some cases several years might elapse between the implementation of the first and the last applications in a sub-system. Exhibit A in the appendix illustrates the priorities of individual applications within sub-systems associated with the student and materials information systems. Chapter XI provides more detailed information about the actual dates for the offering of various services.

SCHEDULE OF INITIAL CURRICULUM DEVELOPMENT, DESIGN, PROGRAMMING AND IMPLEMENTATION MAJOR SYSTEMS & SUB-SYSTEMS

	FY 67[1]				FY 68				FY 69				FY 70				FY 71				FY 72 or Later			
	CD	SD	P	I	CD	SD	P	I	CD	SD	P	I	CD	SD	P	I	CD	SD	P	I	CD	SD	P	I
A. Student Information System																								
1. Census/Elem.		X				X					X					X								
2. Attendance		X				X	X				X	X												
3. Scheduling		X				X	X				X	X												
4. Mark Reporting		X				X	X				X	X												
5. Guidance		X				X					X	X												
6. Health						X									X					X				
B. Materials Information System																								
1. Library						X					X					X								
2. Audio-visual						X					X					X								
C. Administrative/Financial Information System																								
1. Employee Information		X				X	X					X												
2. Accounts Payable										X	X				X	X								
3. Appropr. & Budgetary										X	X				X	X								
4. Property										X									X					X
5. Purchasing/Inventory														X	X				X					X
6. Transportation														X					X					X
7. Maintenance														X					X					X
8. Food Service																		X					X	X
D. Instructional Uses[2]																								
1. Test Scoring & Analysis						X	X					X												
2. Mathematics					X	X					X	X												
3. Business Education					X	X					X	X												
4. Science					X					X					X	X								
5. Social Studies					X					X					X	X								
6. Advanced CAI					X																			

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[1] LEGEND: CD - Curriculum Development, SD - Systems Design, P - Programming, I - Implementation

[2] Implementation of instructional uses in connection with subject areas may not involve use of hardware or software. All implementation involving hardware and software is likely to be a pilot operation and involve uses of hardware other than that available at the cooperative data center.

B. Basis of System, Sub-System and Application Priorities.

Analysis of the Superintendent's Questionnaire indicates the following ranking of potential services:

Potential Service Area	All Groups Gross Points	Ranking
Business Office	749	1
Secondary Student Personnel	525	2
Instructional Uses	449	3
Guidance/Research	390	4
Personnel Records	376	5
Elementary Student Personnel	339	6
Test Scoring	329	7
Census	283	8
Library	230	9
Transportation	218	10
Health Service	161	11
Audio-visual	143	12

1. Administrative and Financial Information System.

For purposes of classification, the Business Office and Transportation areas mentioned above were considered to be elements of this system. While Transportation does not rank very high, the development of the Attendance sub-system provides an excellent opportunity to integrate the Annual Attendance and Transportation Reports, thus providing some services to Transportation.

The Business Office Questionnaire ranked (1) Payroll, (2) Accounts Payable (3) Appropriation and Budgetary Accounting in that order. Other potential Business Office services were considered substantially less beneficial. Personnel Records was 5th-ranked among all potential service areas but since a well-integrated and designed Employee Information sub-system should contain both Personnel Records and Payroll applications, this sub-system is of highest priority within the Administrative and Financial Information System (AFIS). Second-ranking Accounts Payable should have its design closely integrated with Appropriation and Budgetary Control though they can be implemented separately, preferably in the ranking sequence.

Property Accounting was 8th-ranked but its system design must be integrated with the two earlier mentioned sub-systems in order to develop building or functional costs. Approximately 83% of the schools indicated a benefit to this type of data.

Purchasing and Inventory should be combined into a single sub-system and on that basis rank above the Maintenance sub-system containing Preventative Maintenance Scheduling and Maintenance Cost Accounting.

Maintenance and Transportation are considered of comparable benefit though implementation of certain maintenance applications will occur at an earlier date, because they are less complex than some associated with Transportation.

Food Service was considered the area least benefited by data processing services.

2. Student Information System.

For purposes of classification, the areas of Secondary and Elementary Student Personnel, Guidance, Test Scoring, Census & Health Service can be considered elements of the system. Considerable effort will be necessary at the start of design efforts for this system to properly interface all of the sub-systems and take into account the requirements for an electronic student record. In fact, at least moderately detailed system design effort will be required on all sub-systems initially.

While Census is the lowest ranked of all the areas, its detailed systems design should be undertaken first because the Census data will be the foundation for most other sub-systems, though many of the others are scheduled for implementation prior to Census because of their larger benefit.

The Attendance, Scheduling and Mark Reporting sub-systems are intended for nearly simultaneous design, programming and implementation, though each can be implemented separately. This will be necessary in some instances because of a school system's inability to absorb all three during the same time period. These sub-systems would be the first to be implemented within the Student Information System.

Certain Guidance applications are also scheduled for implementation at an early date. These include Followup and Withdrawal Studies, both given the highest benefit ranking by Guidance Personnel.

The Health sub-system was ranked lowest of the sub-systems and, therefore, programming and implementation should proceed at a later date.

3. Instructional Uses System.

For purposes of classification, Test Scoring/Analysis is considered to be an element of this system. Test Scoring was seventh ranked in the Superintendent's Questionnaire. Nevertheless, developments in other areas of the country seem to indicate that services of this type for teacher-prepared and standardized test scores can be highly beneficial. However, acceptance of such a service by teaching personnel may require long lead time, and it is, therefore, desirable to begin offering such a service at the earliest possible date. While feedback from school principals indicates that they consider scoring of standardized tests twice as beneficial as scoring teacher-prepared tests, we believe that systems design and development of programs for both types of tests should proceed simultaneously.

With respect to Instructional Uses involving specific curriculum areas, we believe that early and equal emphasis should be placed on mathematics and business education. With respect to mathematics, many school systems participating in the study had already undertaken steps to include computers in mathematics curriculum. Some 9% of the secondary mathematics teachers in the school systems are already utilizing computers in their classes or in student co-curricular activities. Approximately 21% of the secondary mathematics teachers were considered qualified by the respondents to teach classes or conduct activities related to computers.

Subjective evidence gathered in the course of the planning study indicates that the nature of curriculum material and computer software thus far utilized are all highly varied. Because developments are likely to accelerate with respect to computer use in mathematics classrooms, it seems very important to focus attention at an early date on the orderly development of a curriculum and to establish appropriate hardware/software specifications with respect to that curriculum.

Social studies and science can certainly benefit from computer uses, and consultant personnel for these areas are specified for recruitment shortly after the others.

A consultant in advanced computer related instruction is also specified. It is apparent that developments in this technology require leadership and coordination among metropolitan school personnel. The consultant would provide this in addition to planning and implementing experimental projects involving area school personnel in advanced computer related instruction.

4. Materials Information System.

There are a number of useful data processing services that could be provided in connection with the operation of library and audio-visual. However, these two areas were not ranked sufficiently high by the superintendents to warrant the substantial allocation of resources for implementation until fiscal 1970.

VIII. IMPLEMENTATION CONSIDERATIONS

A. Governing Structure.

1. Structure of Governing Organization.

We believe that the governing structure for this project can be a separate non-profit corporation, a joint board or utilize the existing ERDC structure. Whatever the form, the governing body of the project should be comprised of a single representative for each school system that has indicated its intent to substantially participate in the project. Some changes in statute may be required to implement this recommendation as it relates to non-public schools. Some provision for weighted voting according to school population should be made.

2. Duties of the Governing Body.

a. Policy and Objectives.

The governing body should establish policy and objectives in sufficient detail to charter the actions of various committees. They should also establish time tables for completion of tasks to fulfill the objectives and to appraise the effectiveness of the task execution.

b. Priorities.

The governing body should be responsible for the establishment or approval of priorities as brought to them by the Executive Secretary of ERDC or the Director of Education Services.

c. Income and Expenditure Budgets.

The governing body should delegate to the Executive Secretary of ERDC or the Director of Education Services the responsibility for developing annual budgets of income and expense for their review and approval.

d. Personnel Responsibilities.

The governing body should establish broad personnel policies and delegate authority to the Executive Secretary or the Director of Education Services for recruiting, appraisal, development, termination and compensation of personnel.

e. Committee Membership.

The board should establish the rules for committee membership and appoint committee and sub-committee chairmen and members to serve for a specified period on the recommendation of the Executive Secretary or Director of Education Services.

3. Policy/Technical Committees.

The four policy/technical committees are recommended for initial formation. Additional committees and sub-committees should be formed as needed. The four committees are:

a. Administrative/Financial Information System Policy Committee.

b. Student Information System Policy and Technical Committee.

c. Instructional Uses and Computer Assisted Instruction Policy Committee.

d. Materials Information Systems Policy and Technical Committee.

These committees would have various responsibilities including:

a. Policy and Objectives. Each of the policy and/or technical committees should establish detailed policies and objectives in relation to the various systems and sub-systems under their jurisdiction.

b. Priorities. Any conflicts of emphasis among sub-systems or applications should be resolved by these committees.

c. Systems Design. If the committee is both policy and technical, it should resolve conflicts or make systems decisions brought to it by the project staff.

4. Technical Sub-Committees.

These sub-committees would carry out the same functions as the combined Policy and Technical Committees except that they would not deal with policy matters. On page 77 is a diagram illustrating the committee structure.

5. Educational Information System Coordinator.

Each school system participating in the project would appoint an individual to the position of EIS

Coordinator. This individual would be responsible for most liaison with the data center personnel and would coordinate all data processing services within his school system. All EIS Coordinators would be at least ex-officio members of any committee or sub-committee whose subjects were of current significance to his school system.

This individual should report to a superintendent or assistant superintendent and have a background as a professional educator. Such a person may presently be a principal, assistant principal, guidance counselor or teacher.

We have assumed that the cost of the coordinator would be approximately one dollar per annum per pupil in fiscal 1971 and that his average annual salary would be $12,000.00. The following table indicates the full time equivalency executing the coordinators tasks:

Population (K-12)	Full Time Equivalency
3,000	.25
5,000	.42
10,000	.83
15,000	1.25
20,000	1.67

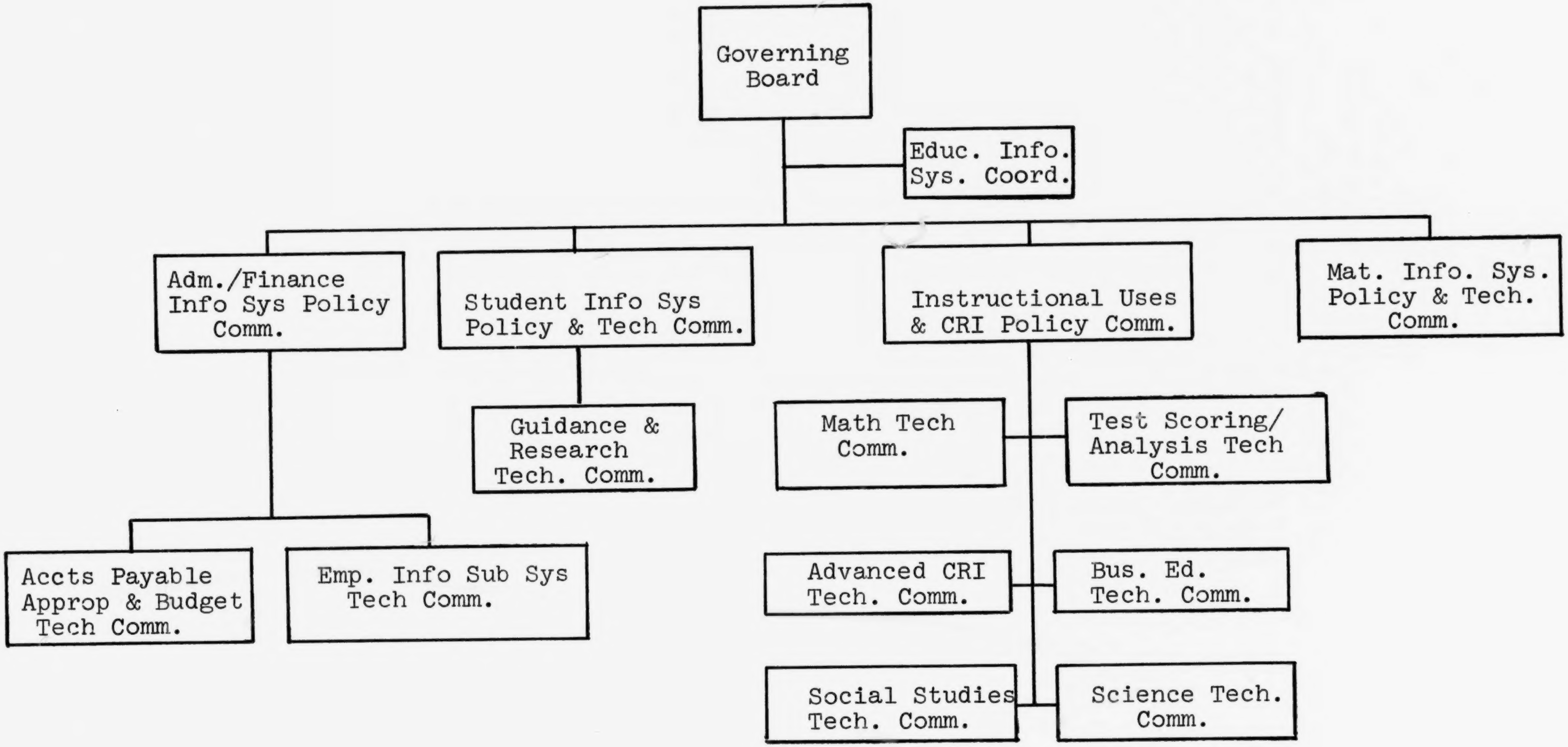
6. Committee/Sub-Committee Membership.

Below are listed the various committees and sub-committees and the job titles of persons who should be appointed to these committees.

COOPERATIVE DATA PROCESSING

POLICY & TECHNICAL COMMITTEE

STRUCTURE


Governing Board
Educ. Info. Sys. Coord.
Adm./Finance Info Sys Policy Comm.
Student Info Sys Policy & Tech Comm.
Instructional Uses & CRI Policy Comm.
Mat. Info. Sys. Policy & Tech. Comm.
Guidance & Research Tech. Comm.
Math Tech Comm.
Test Scoring/ Analysis Tech Comm.
Accts Payable Approp & Budget Tech Comm.
Emp. Info Sub Sys Tech Comm.
Advanced CRI Tech. Comm.
Bus. Ed. Tech. Comm.
Social Studies Tech. Comm.
Science Tech. Comm.

a. Administration/Finance Information System Policy Committee.
  - Superintendents
  - Directors of Business Affairs
  - Directors of Elementary and Secondary Education
  - Elementary and Secondary Principals
  - Personnel Directors
  - Systems Analyst - Ex officio

  1. Employee Information Sub-System Technical Committee.
     - Superintendents
     - Directors of Business Affairs
     - Directors of Elementary and Secondary Education
     - Elementary and Secondary Principals
     - Personnel Directors
     - Systems Analyst - Ex officio
  2. Accounts Payable/Appropriation & Budgetary Technical Committee.
     - Superintendents
     - Directors of Business Affairs
     - Directors of Elementary and Secondary Education
     - Elementary and Secondary Principals
     - Systems Analyst - Ex officio

b. Student Information Systems Policy and Technical Committee.

Directors of Elementary and Secondary Education
Elementary and Secondary Principals
Department Heads or Subject Consultants
Guidance Personnel
Systems Analyst - Ex officio
Research Consultant - Ex officio

1. Guidance and Research Technical Committee.
    Directors of Elementary and Secondary Education
    Elementary and Secondary Principals
    Department Heads or Subject Consultants
    Guidance Personnel
    Systems Analyst - Ex officio
    Research Consultant - Ex officio

c. Instructional Uses and Computer Related Instruction Policy Committee.

Director of Secondary and Elementary Education
Curriculum Director or Coordinator
Secondary and Elementary Principals
Subject Consultants or Department Heads
All Staff Consultants - Ex officio
Systems Analyst - Ex officio

1. Test Scoring/Analysis Technical Committee.
    Director of Secondary and Elementary Education
    Elementary and Secondary Principals

Guidance Personnel
Subject Consultants or Department Heads
Educational Research Consultant - Ex offici
Systems Analyst - Ex officio

2. Mathematics Technical Committee.
    Subject Consultants or Department Head
    Mathematics Teachers
    Curriculum Directors or Coordinators
    Staff Mathematics Consultant - Ex officio
    Systems Analyst - Ex officio
3. Business Education Technical Committee.
    Same as above except Business Education Personnel.
4. Social Studies Technical Committee.
    Same as above except Social Studies Personnel.
5. Science Technical Committee.
    Same as above except Science Personnel.
6. Advanced CRI Technical Committee.
    Directors of Secondary and Elementary Education
    Secondary and Elementary Principals
    Subject Consultants or Department Heads
    Selected Teachers
    Staff Educational Research Consultant - Ex officio

Staff Advanced CRI Consultant - Ex officio

Selected Staff Subject Consultants - Ex officio

d. Materials Information System Policy and Technical Committee.

Librarians
AV Directors
Curriculum Directors or Coordinators
Elementary and Secondary Principals
Subject Consultants or Department Heads
Staff Materials Information System Consultant - Ex officio
Systems Analyst

B. Systems Design Considerations.

1. Systems Design Philosophy.

a. Integrated Systems Concept. Historically, systems utilizing data processing equipment have not taken the integrated systems concept fully into account. In past utilization of electronic computers, some integration has occurred within a particular application and some applications have been integrated to create sub-systems. Usually, however, the integration has consisted largely of attempting to fit applications together *after* they had been designed and implemented separately. Usually they have not integrated well.

The integrated systems concept implies that an over-all structure is first designed for a system, i.e., student information, and that the individual sub-systems, i.e., guidance, attendance, etc., are then designed on a coordinated basis so that they will properly relate to or integrate with the others once implemented. Similarly, the individual applications are designed so that they will have a high degree of integration. We strongly recommend that this concept be extensively utilized in this project. If this is not done, most of the initial systems design and programming effort will have to be redone at a later time in order to create integrated systems, obviously a substantial economic waste.

b. Re-invention. Considerable progress has been made in recent years by elementary and secondary schools in developing many individual applications, i.e., payroll, attendance, scheduling, test scoring, etc. This project should utilize this previous experience in its own system design and whenever possible use the actual programs developed and implemented by others.

c. Leadership of Data Processing Staff. The systems personnel on the staff should provide the leadership with the design efforts. This can be accomplished by using several schools for data collection with respect to formulating a proposed system and bring to the respective policy/technical committees those conflicts that cannot be resolved. The committees can approve and contribute to designs of the data processing staff, but they cannot do the design work.

d. Compatibility and Standardization. Significant effort must be expended to assure that the data that are part of the various systems and sub-systems are compatible. This refers not only to record size and periodicity of recording, but that the classification and coding systems are interpreted uniformly by all participating schools. It will be necessary to standardize certain input/output formats and frequency of input and output. Failure to achieve a significant degree of standardization will result in confused and more costly operations in addition to increasing the systems design and programming effort.

e. Confidentiality. Storage of student and employee information in electronic form and the ease with which it can be reproduced, can create opportunity for abuse. Systems design efforts must carefully take into account the establishment of proper system safeguards to minimize these hazards.

2. Improved Accounting System.

   The study indicates the apparent need to develop an accounting system that develops more meaningful data for the analysis and control of costs, i.e., according to building, function, etc. Substantial involvement of school business officials, superintendents and appropriate resource persons to develop the concepts of such a system should be undertaken at an early date.

3. New Concepts of Budgetary Control.

   Significant opportunity exists in connection with the systems design of the Appropriation and Budgetary Control sub-system to make some substantial advances. The first of these would be that of designing the system so that building principals and the heads of various departments could develop their own budget requests for later modification and consolidation into a system-wide budget. Further, such a system should provide sufficient and timely information so that those persons held accountable for budget items are able to determine the up-to-date status of their budget when faced with new expenditure decisions. A second opportunity exists to permit all parties responsible for developing significant elements of a budget to utilize simulation techniques in that process. Significant progress in this connection has been made in the Oakland Intermediate School system in Pontiac, Michigan. The effect of such simulation techniques has been to allow the exploration of a much wider number of resource allocation alternatives than has been feasible previously.

4. Scheduling/Sectioning Systems.
   a. Computer Development of Master Schedule. Stanford University has made significant progress with respect to utilizing a computer to build a master schedule. Presently, the nature of the hardware and programs required do not make it feasible to consider acquisition of hardware for this particular problem in connection with the initial activities of this project. Serious consideration should be given to utilizing the hardware and programs at Stanford or elsewhere in the country for those schools in any cooperative effort that would benefit by such use.
   b. Modular Scheduling. Once that the schools that will participate in this cooperative effort have been determined, their requirements for modular computer scheduling systems can be examined. Development, modification or acquisition of necessary software can be considered when the scheduling specifications are sufficiently firm. Hardware available to the cooperative effort must be taken into account as a potential limitation.

5. Classification and Coding Systems.

   a. Student Identification. A serious effort should be made to utilize a Social Security number for identification of all children in the metropolitan area. In this connection, negotiations would have to be undertaken with all public and private elementary and secondary systems in the metropolitan area, if adverse public reaction is to be minimized. It is conceivable, however, that such a plan could be adopted by the schools in the cooperative system and no requirement would exist for coordinating with non-participating school systems.

   In the event that the adoption of a Social Security number is not feasible, we believe that all school systems in the project, plus Minneapolis, St. Paul and Robbinsdale school systems should agree on a uniform method of assigning permanent student identification numbers. As children move from district to district, their numbers would remain the same. The student would be provided with appropriate identification media. Master indices would be maintained for look-up purposes at appropriate locations.

b. Employee Identification. Social security numbers should be adopted rather than the use of employee numbers.

c. Course Identification. A common course identification system should be established by all schools participating in the cooperative system. All other school systems in the metropolitan area that would wish to, should participate. Liaison should be maintained with appropriate representatives of colleges and universities in the state so that their requirements can be taken into account.

d. Accounting Codes. As mentioned above, the development of a new accounting system will require that new or revised account numbering systems be established. It is vital that the expense content of each account number be sufficiently agreed upon that reliable, comparable data can be developed among participating schools.

e. Property Coding. A uniform property coding system should be utilized by all participating school systems.

6. Hardware.

a. On-Line Systems. While the initial configuration of on-premise hardware is indicated as being of an off-line variety, we anticipate that it would be modified within a few months of installation to include a capability of handling multiple communication lines and appropriate terminals. Initially such a system would not be intended to handle routine data transmission between individual school buildings and the data center, but rather that the Appropriation and Budgetary Accounting sub-system would require an inquiry system with respect to account status.

In the early and middle 70's, it is likely that technological refinements and cost reduction of hardware will make a time-sharing system more practical for this project. The availability of such a system would have material benefit to all four of the major systems that are the subject of this report, particularly the guidance sub-system, all instructional uses sub-systems, and the employee information sub-system.

The initial configuration has both magnetic tape and direct (random) access capabilities. However, we anticipate that most major permanent records would utilize magnetic tape rather than any other media of storage, at least initially.

b. Optical Scanning. Both eighty column mark sense equipment and an optical page reader have been specified as a result of this study. Optimum advantage should be taken of their availability to minimize input cost with the various data processing services.

C. Curriculum Development.

The earlier portion of this chapter indicated that several instructional uses technical committees should be formed, including the four involving subjects, i.e., mathematics, social studies, business education and science.

These committees would be responsible for guiding the efforts of the staff consultant and in some cases actually preparing drafts of teacher guides and allied materials. However, the staff consultant should have over-all responsibility to provide leadership to the committee so that the following tasks are successfully executed:

1. Curriculum planning, including an adequate survey of the field outside of the Twin Cities metropolitan area and utilization of resource personnel from higher education, industry and other appropriate sources. A large percentage of the metropolitan area teachers should be involved in some aspect of the planning, however limited it may be.
2. Writing of teacher guides, development of computer programs where necessary and preparation of appropriate materials.
3. Development and implementation of comprehensive in-service education programs for teachers.
4. Implementation of curriculum in appropriate pilot schools.
5. Evaluation of curriculum, including completion of initial modifications.
6. Implementation of curriculum on a broad scale.

D. In-Service Education.

Reference has been made to the in-service education programs that should be developed in connection with curriculum. In addition, specific seminars, workshops, courses, etc., should be established for various levels of school personnel. Certain of these in-service programs should be designed for persons unexposed to the subject matter; others should be designed for the moderately exposed. Still other programs of a refresher nature should also be established. Individual programs should be developed for specific groups of school personnel as follows:

1. Superintendents and Assistants or Directors
2. Secondary Principals and Assistants
3. Elementary Principals and Assistants
4. Directors of Business Affairs
5. Subject Consultants (non-curriculum matters)
6. Teachers (non-curriculum matters)
7. Directors of Health Services
8. Directors of Transportation
9. Directors of Food Service
10. Librarians
11. Directors of Audio-visual
12. Selected Secretarial/Office Personnel
13. Coordinators of Education Information System

Emphasis must be given in such in-service programs involving new data processing services to:

1. Adequate explanation of new procedures and why they should be followed.
2. How to interpret information and action that should be taken. Few persons will make significant use of information if they are not trained to interpret it and know how to take the appropriate action. In some instances more time will have to be spent on action techniques than interpretation.

In connection with in-service education programs and the continued successful operation of any data processing services, written procedural manuals must be available and in a language and illustration easily understood by those who must originate or interpret information. Selected elements of these procedure manuals should be placed in a form that lend themselves to visual display in an in-service education program.

E. Selection of a Manufacturer or Supplier.

1. Selection criterion.
    a. Hardware. The hardware selection should be based on at least the following:
        (1) Price/thru-put relationships.
        (2) Variety of devices or components, including flexibility and speed characteristics.
        (3) Hardware/software compatibility both upward into larger configurations and vice versa.

    (4) Expandability. The ability to conveniently and economically add communication lines, storage media, and input/output devices.
    (5) Reliability. Manufacturers' ability to deliver reliable hardware on time.
b. Software. At least the following should be taken into account in evaluating software.
    (1) Variety and comprehensiveness of the various languages.
    (2) Availability of specialized software for sort/merge routines, utility routines and communications requirements.
    (3) Adequacy and number of application programs.
    (4) Completeness and flexibility of operating systems environment.
    (5) Past performance of manufacturer in supplying software on time, thoroughly debugged, and adequately documented.
c. Services. At least the following matters should be taken into account with respect to manufacturers' services:
    (1) Availability of back-up hardware for program testing and provision of operating services.

(2) Extent of educational programs available for various personnel.

(3) Quality and understanding of educational problems exhibited by manufacturers' personnel.

(4) Quality of maintenance services.

(5) Amount of systems design and programming assistance that the manufacturer will provide.

(6) Contract terms, including availability of educational discounts.

2. Selection Methods.

Once that a sufficient number of school systems have agreed to participate in this program and that they concur on the priorities and the systems approaches outlined in this report, specifications can be prepared and released to manufacturers and suppliers in order to receive their proposals. In this instance, proposals would be received for both hourly data center time and on-premise hardware from those manufacturers offering both. Proposals should also be received from data centers who would have hardware compatible with that being proposed by at least one computer manufacturer. These data center proposals should cover hardware and operational personnel only.

Selection should be on the basis of the criterion mentioned earlier. Independent, professional consultants are often utilized in connection with the selection process.

Because of the long lead times in equipment delivery, it appears desirable to resolve the selection matter at the earliest possible date.

IX. PERSONNEL REQUIREMENTS

The numbers of personnel required in various categories as part of this project are indicated in Chapter XIII Budget. The personnel requirements are grouped into five different categories as follows:

1. Administration
2. Staff Consultants
3. Systems/Programming
4. Operations
5. Services/Conversion

Below are the job descriptions for the various types of personnel. On page 121 is a chart that illustrates staff organization. It should be clearly understood that educational attainments specified are minimums.

A. Administration.

1. Director of Education Services.
    a. Qualifications. This individual should have a Master's degree and a Doctorate is highly desirable. He should have prior experience as an outstanding school administrator who has demonstrated understanding of electronic data processing in the education environment. He should have directed others in the planning and implementation of multiple data processing services. More importantly, however, he should be an individual who has demonstrated

skills in working with multiple school districts in cooperative education ventures. In his prior capacities he should have a record for innovation and have demonstrated leadership skills in stimulating others.

b. Responsibilities.

(1) Policy. He would initiate and administer policy appropriate to the internal staff. Where appropriate, he would recommend policy to those to whom he is responsible.

(2) Objectives. He would have over-all responsibility for the formulation of objectives as represented in a detailed plan, including dates for the initiation and completion of various tasks.

(3) Finance. He would have responsibility for developing budgets of income and expense periodically and presenting these to those to whom he is responsible. He would also be responsible for meeting the objectives set forth in the budget.

(4) Personnel. He would have responsibility for the recruitment, retention, supervision, development, termination, and compensation of all staff personnel.

2. Assistant Director of Education Services.
    a. Qualifications. This individual should have a Bachelor's degree and preferably an advanced degree. He should previously have held responsibilities as a school administrator, director of data processing, assistant director of data processing, director or manager of systems and/or programming. He should have demonstrated by previous responsibility, his capacity to direct the activities of others, including both systems/programming and operational personnel. He should also have an understanding of, or demonstrated capability to quickly grasp, the problems and environment of education. His skills and background should tend to complement those of the director.
    b. Responsibilities.
        (1) Objectives. He should assist in formulating the objectives of all those persons under his direction and review their progress with respect to fulfilling the objectives.
        (2) Appraisal. He should appraise the performance of individuals reporting directly to him for subsequent review by the director. He should review the personnel appraisals made by his subordinate personnel.

(3) Coordination. He shall see that all personnel under his direction adequately communicate with each other as appropriate.

B. Consultants.

1. Educational Research Consultant.
    a. Qualifications.
        (1) M. A. in counseling.
        (2) Strong background in research techniques and procedures.
        (3) Knowledge of the concepts of electronic data processing and the mathematical techniques it makes available to research activities.
        (4) Competence in a leadership role.
    b. Responsibilities.
        (1) To develop an on-going research program to measure the effects of educational programs.
        (2) To develop a program of evaluation related of the individual programs.
        (3) To report the results of the measurement and evaluation to all participating public and non-public schools and other interested agencies.

(4) To prepare research designs for proposed programs so that results may be measured appropriately and effectively.

(5) To coordinate the efforts of participating schools related to student personnel records.

(6) To develop an advisory committee on school personnel programs.

2. Mathematics Consultant.

   a. Qualifications.

      (1) B.A. in mathematics or mathematics education.

      (2) Appropriate training in the technical aspects of electronic data processing including experience in Fortran or allied language.

      (3) Able to demonstrate some innovative use of the computer in the mathematics curriculum at the secondary level.

      (4) Some experience in a supervisory capacity including demonstrated leadership skills in group situations.

      (5) Minimum of three years' experience as a secondary school mathematics teacher at the senior high school level.

      (6) Training or experience in curriculum development related to mathematics at the senior high school level.

b. Responsibilities.

(1) Membership on the Mathematics Technical Committee.

(2) Develop contacts with various persons to act as resource persons to the Technical Committee. These persons could be associated with industry, colleges, universities, professional organizations, etc.

(3) Direct and coordinate curriculum development programs in secondary mathematics related to and utilizing the computer for public and non-public school students.

(4) Direct the development of computer programs and materials utilizing educational data processing for secondary school mathematics in public and non-public schools.

(5) Serve as liaison between the Technical Committee and the data processing center systems/programming staff.

(6) Develop, coordinate and direct in-service education programs for mathematics teachers from participating public and non-public schools related to new curriculum, programs and materials.

(7) Direct the development and implementation of special services of the data processing center developed for students and staff members from participating schools.

(8) Prepare the following:

(a) A curriculum utilizing the computer as a means of teaching mathematics.

(b) Recommendations which will establish and maintain the proposed curriculum.

(c) Survey of existing computer resources which might be utilized to establish and maintain the projected program(s).

3. Business Education Consultant.

a. Qualifications.

(1) B. A. in business education.

(2) Appropriate training in the technical aspects of data processing, including familiarity with computer and punch card equipment.

(3) Experience in programming with assembly languages such as Autocoder, Easycoder, Cobol, etc.

(4) Previous demonstrations of innovative use of data processing equipment in the

business education curriculum at the senior high school level.

(5) Some experience in a supervisory capacity including demonstrated leadership skills in group situations.

(6) Training or experience in curriculum development or innovation related to business education on the senior high school level.

b. Responsibilities.

(1) Membership to the Business Education Technical Committee.

(2) Develop contacts with resource persons from colleges and universities, other secondary schools, businesses, etc., for the benefit of the Technical Committee.

(3) Direct and coordinate curriculum development in business education, related to and utilizing data processing equipment for public and non-public school students.

(4) Develop appropriate programs and materials utilizing educational data processing for business education at the secondary level in public and non-public schools.

(5) Serve as liaison between the Business Education Technical Committee and the data processing center systems/ programming staff.

(6) Develop, coordinate and direct in-service education programs for teachers from participating public and non-public schools for the implementation of revised or new curricula.

4. Social Studies Consultant.

a. Qualifications.

(1) M. A. in social studies education.

(2) Appropriate training in the technical aspects of data processing, including some knowledge of or experience in computer programming.

(3) Some experience in a supervisory capacity including demonstrated leadership skills in group situations.

(4) Minimum of three years' experience as a secondary school social studies teacher at the senior high school level.

(5) Significant demonstrated interest in the various impacts on society of electronic computers.

b. Responsibilities.

(1) Recommend membership to the Social Studies Technical Committee.

(2) To direct and coordinate curriculum development in secondary school social studies related to and utilizing the computer for public and non-public students.

(3) To direct the development of programs and materials utilizing educational data processing for secondary school social studies students in public and non-public schools.

(4) To serve as a liaison between Social Studies Technical Committee and the data processing center systems/ programming staff.

(5) To develop, coordinate, and direct in-service education for social studies teachers from participating public and non-public schools for the implementation of new programs.

(6) To direct the development and implementation of the data processing center developed for students and staff members from participating schools.

(7) To prepare the following:

(a) A curriculum utilizing or taking the computer into account insofar as it bears on the curriculum of social studies.

(b) Survey existing resources which may be utilized to establish and maintain the projected program.

5. Science Consultant

a. Qualifications.

(1) M. A. in a science or science education.

(2) Appropriate training in the technical aspects of data processing and prior experience in adopting computers to a classroom environment.

(3) Some experience in a supervisory capacity, including demonstrated leadership skills in group situations.

(4) Minimum of three years' experience as a secondary school science teacher at a senior high school level.

(5) Experience or knowledge of computer programming.

b. Responsibilities.

(1) To recommend membership to the Science Technical Committee.

(2) To direct and coordinate curriculum development in secondary school science related to and utilizing the computer for public and non-public students.

(3) To direct the development of computer programs and materials utilizing educational data processing for secondary school science students in public and non-public schools.

(4) To serve as a liaison between the Science Technical Committee and the data processing center systems/programming staff.

(5) To develop, coordinate, and direct in-service education for science teachers from participating public and non-public schools for the implementation of new programs.

(6) To direct the development and implementation special services of the data processing center for students and staff members from participating schools.

(7) To prepare the following:

    (a) A curriculum utilizing the computer to teach the science or aspects thereof.

(b) Survey existing computer resources which may be utilized to establish and maintain the projected program.

6. Advance Computer Related Instruction (CRI) Consultant.

a. Qualifications.

(1) M. A. with strong background in curriculum and instruction.

(2) Experience in working with and knowledge of the development of programmed instruction.

(3) Five years of teaching experience.

(4) Knowledge of and experience in computer applications to instruction.

(5) Experience in a supervisory capacity and demonstrated leadership skills in group situations.

b. Responsibilities.

(1) General responsibility for over-all coordination and/or supervision of all advanced computer related instruction activities.

(2) To assist in curriculum development of advanced computer related instructional programs pertaining to mathematics, business education, science, social studies, etc.

(3) Develop specialized programs, as designated by particular schools for implementation in their curriculum, with special emphasis initially on mathematics and business education.

(4) Direct in-service education programs relating to advanced CRI.

(5) To develop materials related to specialized programs and needs of teachers.

(6) Work with subject consultants curriculum directors and administrators to develop and implement innovative programs in the subject matter areas related to advanced CRI.

7. Materials Information Consultant.

a. Qualifications.

(1) M. A. in library science.

(2) Knowledge of computer and image storage potentialities relating to educational materials.

(3) Experience in a supervisory capacity and demonstrated leadership skills in a group environment.

b. Responsibilities.

(1) To analyze organizational and work patterns and determine areas which

may be improved within existing systems.

(2) To develop concepts and details of operations which will result in new opportunities for creative use of library materials and facilities.

(3) To develop concepts and details of applying new technology to storage and retrieval of educational information.

(4) To coordinate the utilization of data processing services cooperating school systems, including book processing, union catalogue, circulation control, reading pattern inventory, and student/class profiles.

(5) To develop in-service education programs to fit specialized needs of cooperating school systems.

(6) To work with the materials informations system policy and technical committee to plan the implementation of priorities to be served.

C. Systems/Programming.

1. Systems/Programming Manager.

a. Qualifications. Individuals in this capacity should have a Bachelor's degree. He should have prior experience as a systems/programming manager or assistant or have otherwise demonstrated his supervisory skills with systems/programming personnel.

b. Responsibilities.

(1) Policy. He should initiate policy where appropriate and administer all policy relating to his area of responsibility.

(2) Objectives. He should assist personnel under his direction in formulating objectives and where appropriate establish objectives for those under his jurisdiction.

(3) Coordination. He should make certain that all personnel under his direction adequately coordinate their activities with other appropriate parties.

2. Systems Analyst.

a. Qualifications. Individuals in this capacity should preferably have a Bachelor's degree. They should have demonstrated in prior employment that they possess above average analytical skills, a capacity to work and communicate easily with a wide variety of personnel, a good understanding of hardware and software and the ability to develop adequate documentation with respect to their work. This individual should have a capacity to communicate in writing. He should also previously have demonstrated the capacity to supervise programmers under his jurisdiction.

b. Responsibilities.

(1) Objectives. He should formulate the written objectives with respect to his area of information system responsibility, and review these plans and their fulfillment periodically with his supervisor.

(2) Supervision. He should supervise the programmers under his jurisdiction and develop jointly with them a definition of their responsibilities.

(3) Appraisal. He should periodically appraise the performance of personnel under his direction and make recommendations to his immediate supervisor.

(4) Coordination. He should maintain adequate communication with all other persons working on information systems having some relationship to his and assure that personnel under his direction are communicating adequately with each other in this same connection.

(5) Design and Documentation. Through contact with school personnel and the appropriate technical committee, he should formulate the system, sub-system and application design for those areas under his responsibility. He should create the necessary documentation to explain the proposed design of systems, sub-systems and applications to school personnel and to obtain their approval of the design. Documentation should also be adequate so as to provide the necessary data to programming personnel under his direction.

(6) Committee Membership. He shall be an ex-officio member of the technical committee appropriate to his area of responsibility. He shall also take the initiative with respect to the subjects the committee would deal with in setting forth the alternatives upon which the committee would base a decision.

(7) In-service Education. He should, in conjunction with services/conversion personnel, formulate the in-service

education program appropriate to his particular system. It should be his responsibility to develop the necessary curriculum units and materials to be used by himself and by the services/ conversion personnel. He should resolve on the advice of the assistant director or systems/programming manager the division of responsibilities between himself and his staff and the services/ conversion personnel with respect to the implementation of a new data processing service and its subsequent use by other school systems.

2. Programmer.
   a. Qualifications. These individuals should have a minimum of a high school diploma and have had a minimum of one year's experience with programming systems involving tape or direct-access oriented hardware. He should have demonstrated above average capabilities in his prior employment as a programmer.
   b. Responsibilities.
      (1) Objectives. He should formulate objectives with his immediate supervisor and review progress in meeting these objectives with him periodically.

(2) Design and Coding. Utilizing the documentation supplied him by the systems analyst, he should undertake any detailed design work that may be necessary and code and debug his programs to place them in operational status.

(3) Documentation. He should maintain adequate documentation of his design and coding activities so that communication with systems and operational personnel is satisfactory.

(4) Coordination. He should communicate adequately with other staff personnel to insure a proper interface between his programs and others that may have to interface with it.

(5) In-service education. He should perform whatever in-service activities are deemed appropriate by the systems analyst and services/conversion personnel.

D. Operations.

1. Manager of operations.

a. Qualifications. This individual should have at least a high school diploma and have previously served in a position as manager or assistant manager of operations. He should have demonstrated in his previous employment a capacity for supervising others and a consistent capacity to meet the schedules in effect. He should also have had a minimum of six months experience in programming, or its equivalent.

b. Responsibilities.

1. Objectives. He should formulate objectives for the department and periodically review these objectives with his immediate supervisor.
2. Appraisal. He should periodically appraise the personnel under his jurisdiction and make compensation recommendations.
3. Coordinate. He should coordinate the activities of his department so that the requirements of all staff personnel are met.
4. Scheduling. He should schedule the operation of his department so as to meet the requirements of those to whom data processing services are being provided. This will involve communications with school personnel wherein an older service is being utilized. For all new services,

he should communicate with services/conversion personnel in addition to those in a particular school.

2. Other Operational Personnel.

Below are the titles of various personnel and brief descriptions of their responsibilities.

   a. Computer/Machine Operator.

      These personnel would be responsible for the operations of the computer hardware and other machines appropriate to the functioning of the data center.

   b. Control Personnel. These individuals would be responsible for reviewing input from the various schools and assuring the adequacy of controls. Similarly they would receive the output and review its completeness and accuracy before transmittal to the school systems.

   c. Secretaries. They would provide necessary secretarial assistance to the staff.

   d. Keypunch Operators. They would perform all keypunch and key verification operations necessary to the proper operation of the data center.

   e. Transportation Personnel. These individuals would physically transport data between the school systems and the data center.

f. Accountant. This individual would be responsible for the maintenance of appropriate financial and operational records. Emphasis would be placed on those records necessary for creation of cost data on systems design and programming. He would also be responsible for allocations associated with new or added membership in the cooperative operation.

E. Services/Conversion Personnel.

1. Services Coordinator.

a. Qualifications. This individual should have a Bachelor's degree and prior experience as a programmer or systems analyst. He should have an outstanding capability in working with all types of individuals and be particularly skilled in understanding the problems to which data processing is to be applied in the school systems. It is desirable though not necessary that this individual have taught at some time in his career. This individual should possess above average written and verbal communication skills. He should also have demonstrated the capacity to supervise the direction of others.

b. Responsibilities.

(1) Supervision of conversions. He would have overall responsibility for supervising the conversions at each school system and to direct the activities of his staff members in that connection.

(2) Negotiations. He would be responsible within the framework of authority delegated to him to call on school systems not participating in the cooperative data processing program and work out arrangements suitable to the prospective school system and the data center. This would include development of at least the following:

(a) Costs.

(b) Schedules of conversion and subsequent service.

(c) Selection of the school systems Education Information Systems Coordinator.

2. Conversion Coordinator and Assistants.

a. Qualifications. These individuals should have at least six months prior experience in programming. They should have good verbal communication skills and be able to work easily with a wide variety of school personnel. They should be individuals with an above average interest in technical details.

(3)

Preferably they have some prior experience with communication terminals.

b. Responsibilities.

(1) Conversion schedules. These individuals would work with the EIS coordinators in the individual school systems to develop appropriate conversion schedules. They would assemble the necessary materials appropriate to the conversion and make them available to the school personnel. They would also assist the school personnel in preparing data necessary for the conversion.

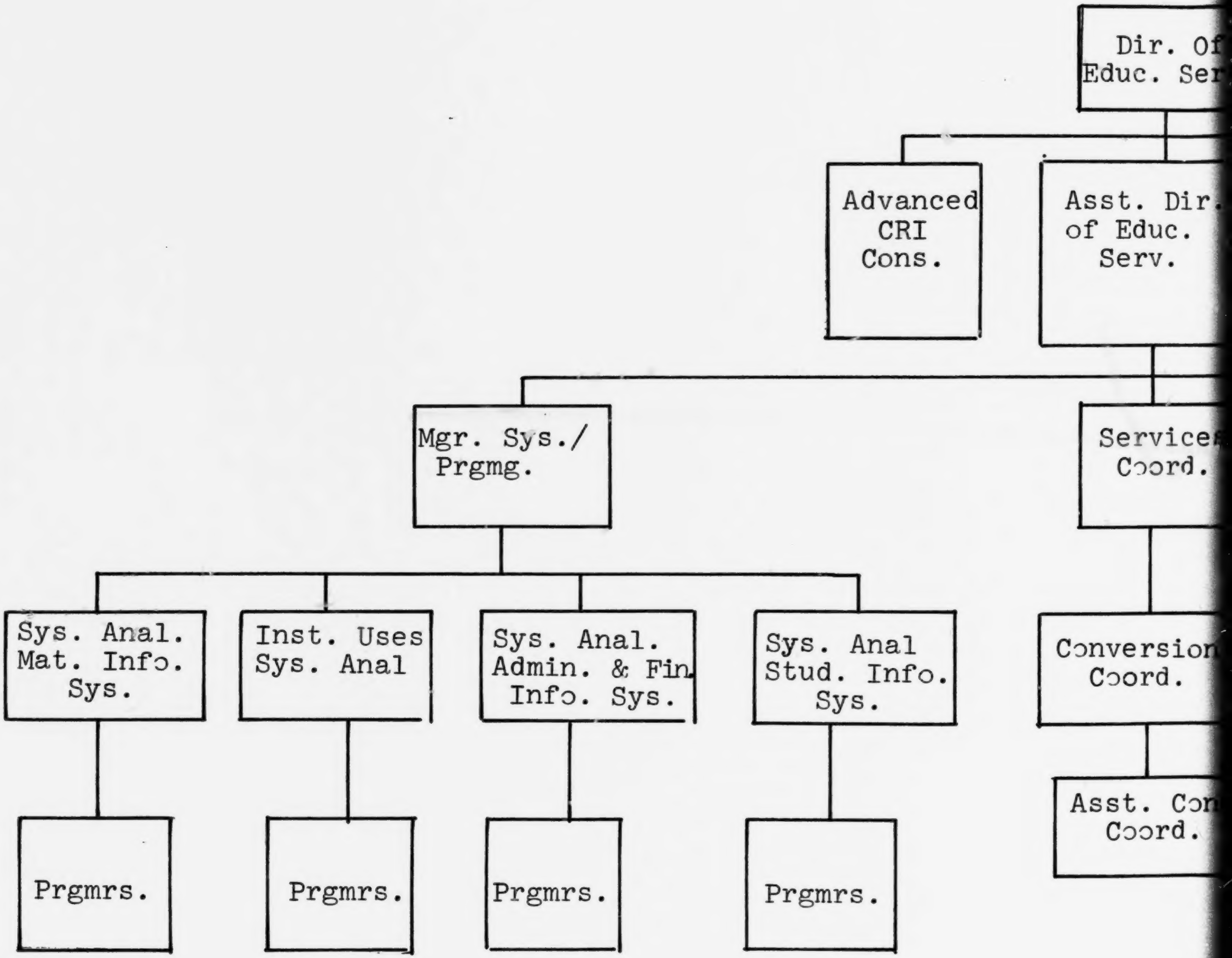
(2) In-service education. For selected data processing services, they would conduct the in-service education sessions for school personnel. In other instances, they would execute this task jointly with the systems analysts or others.

(3) Expedite. During the days or weeks of conversion, these individuals would work closely with school, programming, systems, and operations personnel in order to assure that the difficulties of conversion are kept to a minimum and that all unsatisfactory conditions are corrected as quickly as possible.

(4) Systems Revision. These individuals will serve as the communicators of revisions that need be made to existing applications in order to improve upon them or meet the requirement of an individual school system that can not be resolved in any other way.

STAFF ORGANIZ

FOR COOPERATIVE DATA


Dir. Of
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Advanced CRI Cons.
Asst. Dir. of Educ. Serv.
Mgr. Sys./ Prgmg.
Services Coord.
Sys. Anal. Mat. Info. Sys.
Inst. Uses Sys. Anal
Sys. Anal. Admin. & Fin. Info. Sys.
Sys. Anal Stud. Info. Sys.
Conversion Coord.
Asst. Con Coord.
Prgmrs.
Prgmrs.
Prgmrs.
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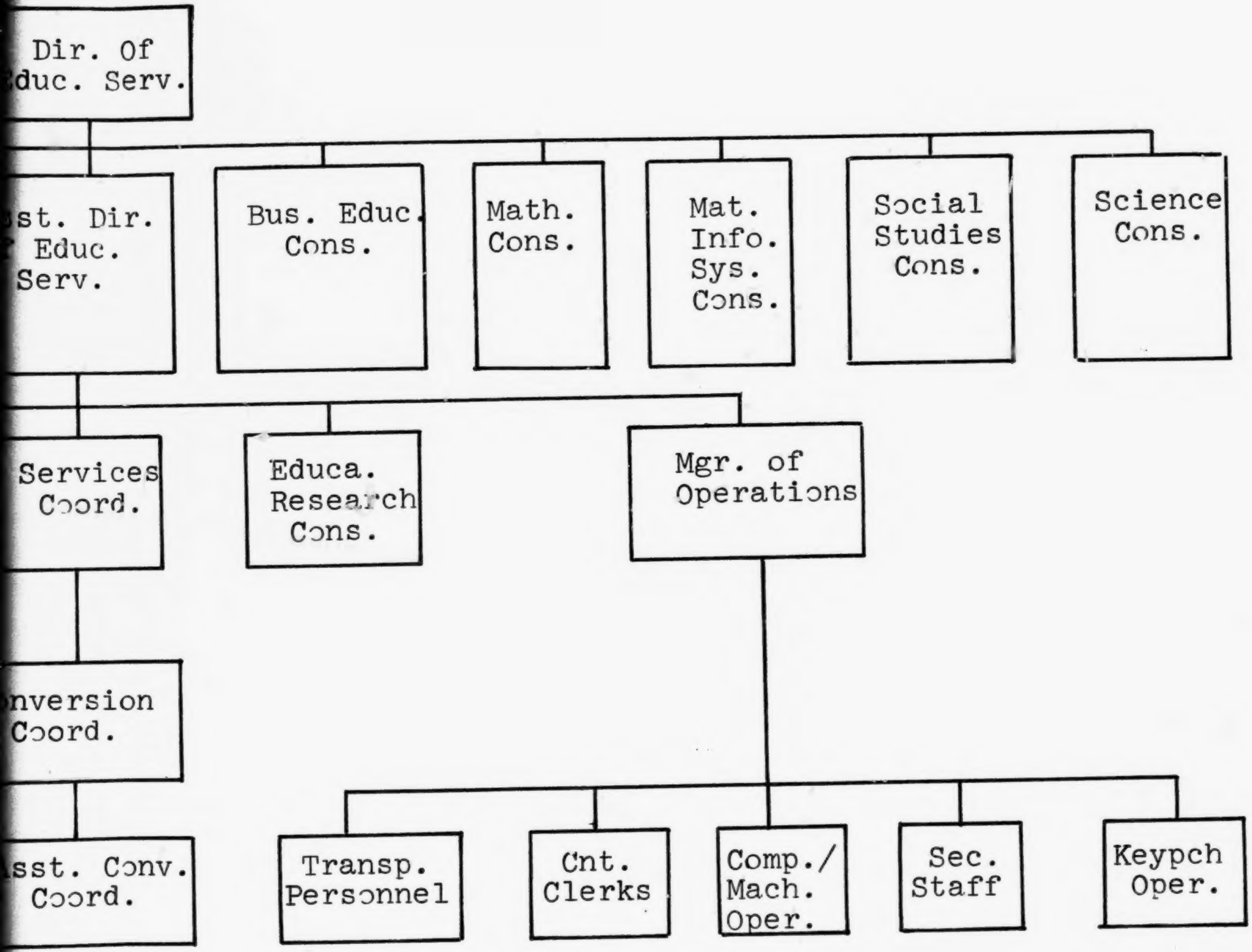
ORGANIZATION

IVE DATA PROCESSING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Clerks
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Mach.
Oper.
Sec.
Staff
Keypch
Oper.

X. FUNCTIONAL HARDWARE AND SOFTWARE CHARACTERISTICS.

All of the characteristics as stated below should be considered minimum. Once that the initial number of school systems participating in the program have been determined, it may be necessary to decrease or increase these characteristics.

A. Hardware.

1. Remote Terminals. They should be of the serial (typewriter) variety with "hard copy" output of at least 10 char./sec. It may be desirable that the terminal have punched paper tape input and output.

2. Central Input/Output.

    a. Card Reading/Punching. The equipment should be capable of reading cards at a peak speed of not less than 500 CPM. Punching should occur at a peak speed of not less than 100 CPM (80cc punching).

    b. Punched Paper Tape. It is not anticipated that punched paper tape would be utilized though it may be a serious possibility for the Accounts Payable/Approp. and Budgetary Accounting sub-systems.

    c. Printing. A line printer capable of printing alpha numeric data at a rated peak speed of at least 600 LPM will be required.

3. Central Processor. The central processor should have a minimum of between 16-32 K positions of alpha numeric memory for batch processing and up to 64 K when communication capabilities are added.

The central processor should be capable of accomodating several types of I/O devices in an overlapped mode. Storage protection should be available when communication capabilities are added. The system must be able to operate in a multi-programming environment.

4. Auxiliary Storage. The main file storage media should be magnetic tape except for the direct (random) access storage required for the files which will be in an inquiry status or utilized as temporary storage. Random or direct access files may also be desirable or necessary for an operating system. A minimum of four tape drives of not less than 30 KC read/write speed should be available. The direct access file should have a capacity for no less than 5 million alpha numeric characters.

5. Communications. The communications equipment required for transmission of data, in the conversational mode, between the terminals and the computer should be capable of operating over voice grade leased lines of 180 baud or less. The communications "front end" should be capable of accommodating 20 or more lines.

6. Special equipment.

   a. Key punches. The key punches should be capable of punching alpha numeric information into 80 column cards. It should also have the ability for format selection, auto-duplication, auto-skipping and auto-feeding.

   b. Test scoring equipment. The test scoring equipment should be capable of reading and scoring at least 1,000 documents per hour. It should have some code selection capability.

   c. Card sorters. The card sorters should have the capability of sorting at least 600 cards per minute.

   d. Card reproducers. The card reproducers should have the capability of selectively reproducing punched cards at speeds of 100 cards per minute or more.

   e. Card interpreters. The card interpreter should have the capability of alpha numerically interpreting punched card information at the rate of 60 cards per minute or more.

B. Software.

1. System.

The programming support provided should cover all components of the system including the necessary support for the communication equipment.

The software should be integrated into an operating system support package.

Several language compilers should be available in the software, i.e., Fortran, Cobol, etc.

2. Applications.

The manufacturer should provide a list of application packages available for and pertaining to schools. These packages should be well documented and available at the scheduled installation date.

XI. PLAN OF ACTION

A. CPM. Network.

The Critical Path Method (CPM) is one of several network techniques that have been developed in recent times for project control. On the following page is a CPM network developed for implementation of the coordinated data processing project.

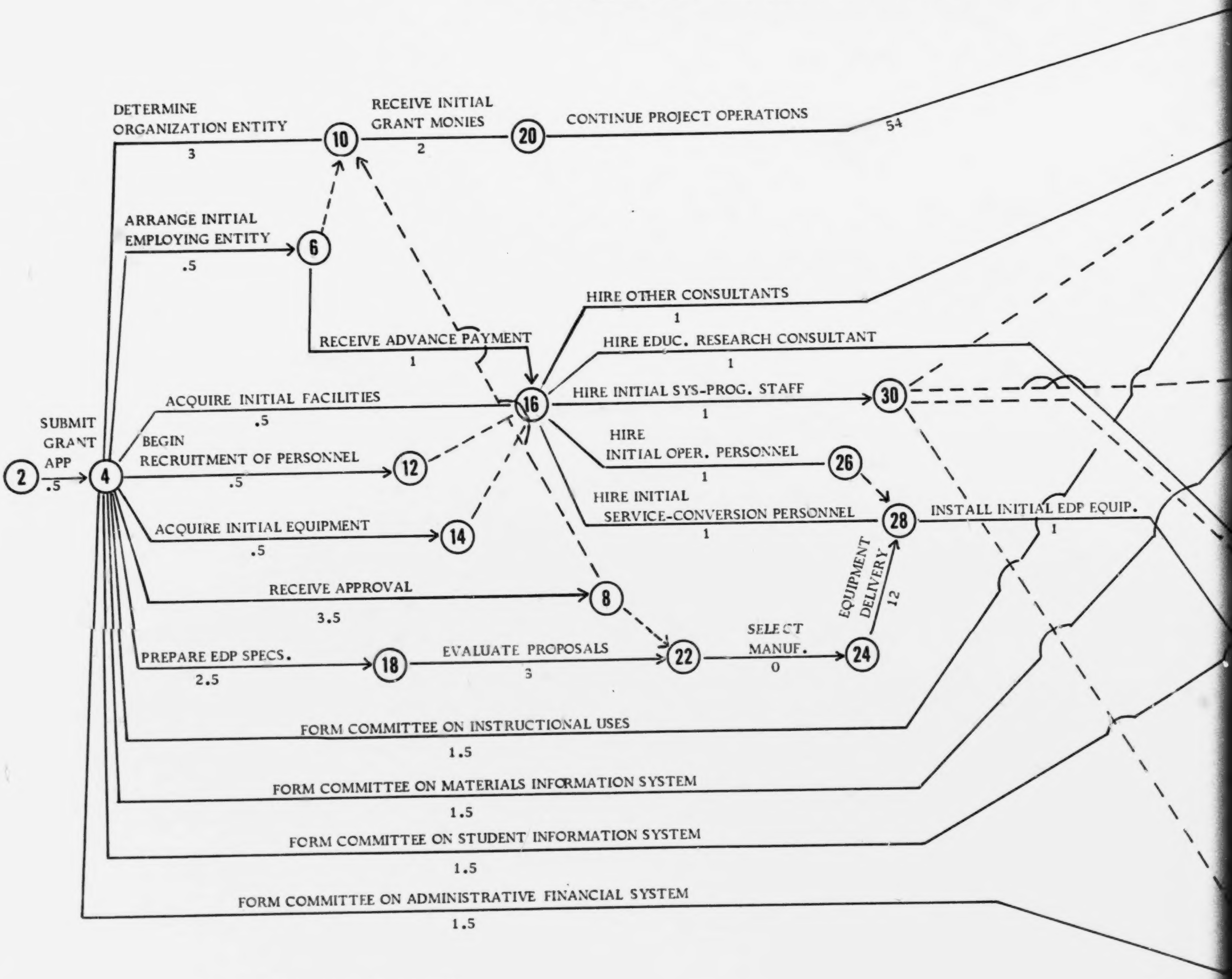
Each circle represents the completion of the activity indicated on the line preceding it. When multiple dotted or solid lines precede the circle, all of those activities must be completed before any subsequent activity on that path can be completed. The numbers in the circles are simply activity identification. The number next to the activity lines represent the maximum duration or elapsed time available between start and completion of the activity in calender months.

Networks and allied schedules should be developed for each sub-system once that the project is approved for implementation. Reporting systems for those networks should be integrated with the personnel time reporting and cost accounting systems that should be developed as part of implementing the project plans.

B. Systems/Programming Personnel Schedule.

1. Estimating Man Months. The first step in establishing the schedule was estimating the man months required for each activity. Unfortunately adequate data

COORDINATED DATA PROCESSING PROJECT CPM NETWORK

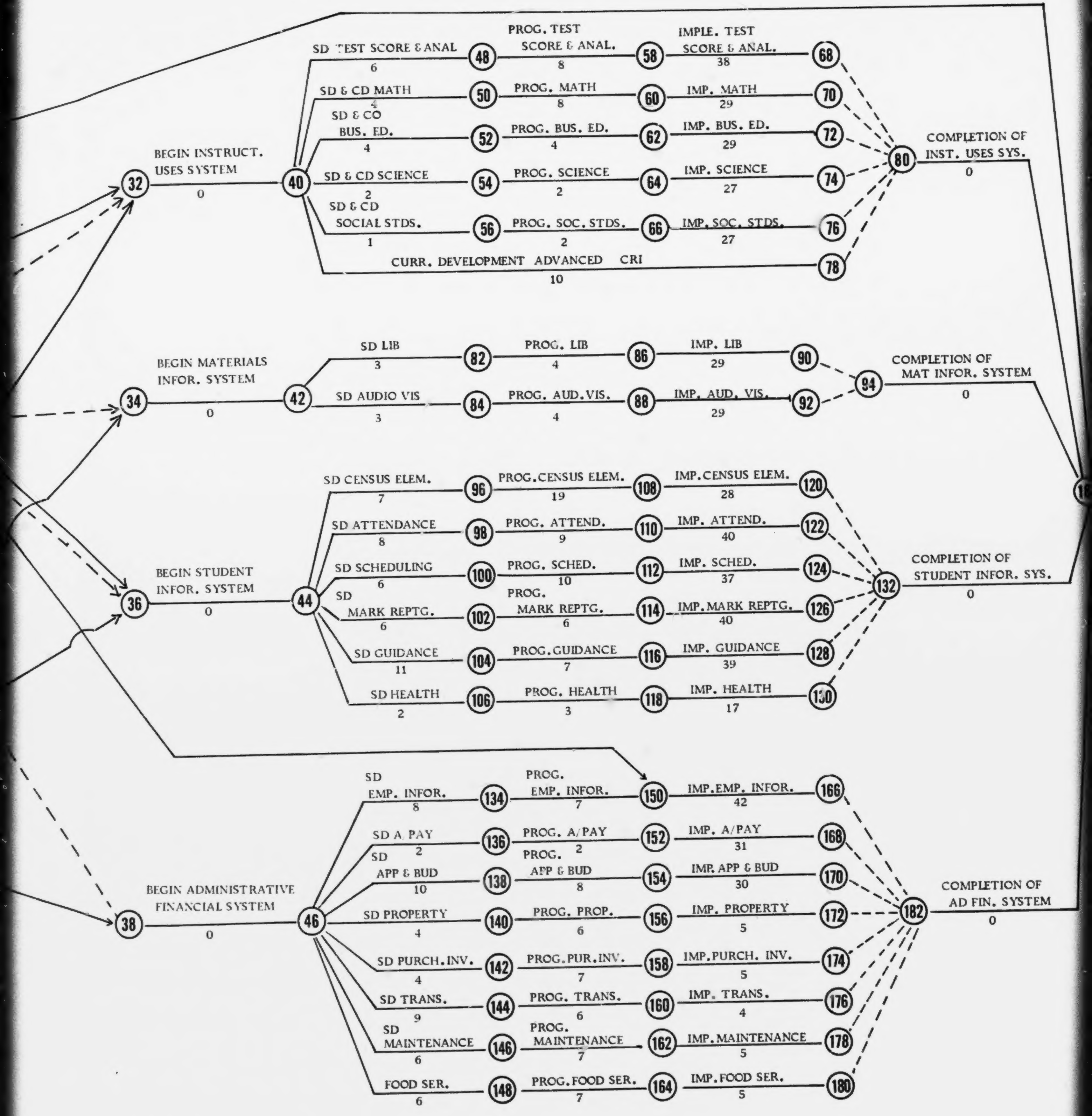

DETERMINE ORGANIZATION ENTITY
3
10
RECEIVE INITIAL GRANT MONIES
2
20
CONTINUE PROJECT OPERATIONS
54
ARRANGE INITIAL EMPLOYING ENTITY
.5
6
RECEIVE ADVANCE PAYMENT
1
HIRE OTHER CONSULTANTS
1
HIRE EDUC. RESEARCH CONSULTANT
1
HIRE INITIAL SYS-PROG. STAFF
1
30
HIRE INITIAL OPER. PERSONNEL
1
26
HIRE INITIAL SERVICE-CONVERSION PERSONNEL
1
28
INSTALL INITIAL EDP EQUIP.
1
16
ACQUIRE INITIAL FACILITIES
.5
SUBMIT GRANT APP
.5
2
4
BEGIN RECRUITMENT OF PERSONNEL
.5
12
ACQUIRE INITIAL EQUIPMENT
.5
14
RECEIVE APPROVAL
3.5
8
EQUIPMENT DELIVERY
12
PREPARE EDP SPECS.
2.5
18
EVALUATE PROPOSALS
3
22
SELECT MANUF.
0
24
FORM COMMITTEE ON INSTRUCTIONAL USES
1.5
FORM COMMITTEE ON MATERIALS INFORMATION SYSTEM
1.5
FORM COMMITTEE ON STUDENT INFORMATION SYSTEM
1.5
FORM COMMITTEE ON ADMINISTRATIVE FINANCIAL SYSTEM
1.5

1. Explanation of Arrow

   A. ② Name of activity → ④
      Duration of Activity
      (calendar months)

   B. 2-4 is number identifier for each activity such as 2-4 is submit grant application

2. Dotted arrow indicates indirect dependency of one activity on another.



BEGIN INSTRUCT. USES SYSTEM
SD TEST SCORE & ANAL
PROG. TEST SCORE & ANAL.
IMPLE. TEST SCORE & ANAL.
SD & CD MATH
PROG. MATH
IMP. MATH
SD & CD BUS. ED.
PROG. BUS. ED.
IMP. BUS. ED.
SD & CD SCIENCE
PROG. SCIENCE
IMP. SCIENCE
SD & CD SOCIAL STDS.
PROG. SOC. STDS.
IMP. SOC. STDS.
CURR. DEVELOPMENT ADVANCED CRI
COMPLETION OF INST. USES SYS.
BEGIN MATERIALS INFOR. SYSTEM
SD LIB
PROG. LIB
IMP. LIB
SD AUDIO VIS
PROG. AUD.VIS.
IMP. AUD. VIS.
COMPLETION OF MAT INFOR. SYSTEM
BEGIN STUDENT INFOR. SYSTEM
SD CENSUS ELEM.
PROG.CENSUS ELEM.
IMP.CENSUS ELEM.
SD ATTENDANCE
PROG. ATTEND.
IMP. ATTEND.
SD SCHEDULING
PROG. SCHED.
IMP. SCHED.
SD MARK REPTG.
PROG. MARK REPTG.
IMP.MARK REPTG.
SD GUIDANCE
PROG.GUIDANCE
IMP. GUIDANCE
SD HEALTH
PROG. HEALTH
IMP. HEALTH
COMPLETION OF STUDENT INFOR. SYS.
BEGIN ADMINISTRATIVE FINANCIAL SYSTEM
SD EMP. INFOR.
PROG. EMP. INFOR.
IMP.EMP. INFOR.
SD A. PAY
PROG. A/PAY
IMP. A/PAY
SD APP & BUD
PROG. APP & BUD
IMP. APP & BUD
SD PROPERTY
PROG. PROP.
IMP. PROPERTY
SD PURCH.INV.
PROG.PUR.INV.
IMP.PURCH. INV.
SD TRANS.
PROG. TRANS.
IMP. TRANS.
SD MAINTENANCE
PROG. MAINTENANCE
IMP. MAINTENANCE
FOOD SER.
PROG.FOOD SER.
IMP.FOOD SER.
COMPLETION OF AD FIN. SYSTEM

was not available to allow a high degree of accuracy in this task. However, the estimates are appropriate and necessary. They should be continuously revised as the project proceeds.

The total man months assumes that all components of the sub-systems as indicated in the appendix (Pages 1 - 7) are included. The largest danger will be that personnel allow time to slip by because there seems to be so much available.

In the case of the Instructional Uses, it was assumed that fifty percent of the systems/programming effort could occur after the initial implementation. Because Instructional Uses are highly undefined, the man month estimates could vary widely as plans are developed by the staff consultants. With most other sub-systems, it was assumed that only 25% of the systems/programming effort could occur after initial implementation of the sub-system.

2. Number of Personnel. It was assumed that the computer manufacturer would supply three persons for a total of fifty four man months. It was also assumed that systems/programming personnel would have skills that would be utilized on an overlapping basis. A total of ten systems/programming personnel were assumed. Beginning in FY 1970, the schedule does not indicate a requirement for these numbers of

personnel. It is quite likely however that new systems design and programming requirements will emerge, most significantly in instructional uses. Additionally, widespread use of communication based data processing services will probably require considerable effort to place in operation.

Some variation exists in FY 1970 & 71 as to the total numbers of personnel required from month to month. We anticipated that this imbalance will be corrected by the project staff in the interim.

C. Activity Schedule.

The schedule below sets forth several factors associated with the principal activities of this project. Duration and man months have the same meanings as indicated previously. Scheduled start date cannot be missed unless more personnel are made available in the period between start and completion or if the duration time is revised downward. Completion dates missed will have the effect of delaying subsequent activities of the project.

ACTIVITY SCHEDULE

TOTAL PROJECT DURATION: 59 MONTHS

1/1/67 - 12/1/71

Activity Identification		Description	Duration	Man Months	Scheduled Start	Scheduled Completion
2	4	Submit Grant Application	.5		1/1/67	1/15/67
4	10	Determine Organizational Entity	3		1/15/67	5/1/67
4	6	Arrange Initial Employing Entity	.5		1/15/67	2/1/67
4	16	Acquire Initial Facilities	.5		1/15/67	2/1/67
4	12	Begin Recruitment of Personnel	.5		1/15/67	2/1/67
4	14	Acquire Initial Equipment	.5		1/15/67	2/1/67
4	8	Receive Approval	3.5		1/15/67	5/1/67
4	18	Prepare EDP Specs	2.5		1/15/67	4/1/67
4	34	Form Committee on Mat Information Sys	1.5		1/15/67	3/1/67
4	36	Form Committee on Student Information System	1.5		1/15/67	3/1/67
4	38	Form Committee on Administrative Financial Sys	1.5		1/15/67	3/1/67
6	16	Receive Advance Payment	1		2/1/67	3/1/67
16	36	Hire Research Consultant	1		2/1/67	3/1/67
16	30	Hire Initial Systems Programming Staff	1		2/1/67	3/1/67

Activity Identification		Description	Duration	Man Months	Scheduled Start	Scheduled Completion
44	98	Systems Design Attendance	8	8	3/1/67	11/1/67
44	104	SD Guidance	11	13	3/1/67	2/1/68
46	134	SD Employee Information	8	13	3/1/67	11/1/67
18	22	Evaluate Proposals	3		4/1/67	7/1/67
44	100	SD Scheduling	6	6	5/1/67	11/1/67
44	96	SD Census Elem	7	19	6/1/67	1/1/68
4	32	Form Committee on Instructional Uses	1.5		6/15/67	8/1/67
22	24	Select EDP Equipment Manufacturer	0		7/1/67	7/1/67
24	28	EDP Equipment Delivery	12		7/1/67	7/1/68
10	20	Receive Grant Monies	1		7/1/67	8/1/67
16	32	Hire Other Consultants	1		7/1/67	8/1/67
40	48	SD Test Score	6	6	8/1/67	2/1/68
44	102	SD Mark Reporting	6	6	8/1/67	2/1/68
20	184	Continued Project Operations	51		8/15/67	12/1/71
98	110	Program Attendance	9	10	11/1/67	8/1/68
100	112	Program Scheduling	10	19	11/1/67	11/1/68
134	150	Program Emp Information	7	17	11/1/67	6/1/68
46	138	SD Appropr & Budgetary	10	13	12/1/67	10/1/68

Activity Identification		Description	Duration	Man Months	Scheduled Start	Scheduled Completion
96	108	Program Census	19	23	1/1/68	8/1/69
48	58	Program Test Score	8	12	2/1/68	10/1/68
102	114	Program Mark Reporting	6	12	2/1/68	8/1/68
104	116	Program Guidance	7	17	2/1/68	9/1/68
16	26	Hire Initial Operations Pers	1		4/1/68	5/1/68
16	28	Hire Initial Service Conversion Pers	1		4/1/68	5/1/68
28	150	Install Initial EDP Equipment	1		5/1/68	6/1/68
150	166	Implement Employee Infor	42	8	6/1/68	12/1/71
40	50	SD Mathematics	4	4	7/1/68	11/1/68
110	122	Implement Attendance	40	4	8/1/68	12/1/71
114	126	Implement Mark Reporting	40	4	8/1/68	12/1/71
116	128	Implement Guidance	39	7	9/1/68	12/1/71
40	78	Curriculum Development ADV. CRI	10	11	9/1/68	7/1/69
58	68	Implement Test Score	38	8	10/1/68	12/1/71
40	52	CD & SD Business Education	4	7	10/1/68	3/1/69
138	154	Program Appropr & Budgetary	8	17	10/1/68	6/1/69
112	124	Implement Scheduling	37	6	11/1/68	12/1/71
50	60	Program Mathematics	8	15	11/1/68	7/1/69
42	82	SD Library	3	3	12/1/68	3/1/69
42	84	SD Audio Visual	3	3	12/1/68	3/1/69

Activity Identification		Description	Duration	Man Months	Scheduled Start	Scheduled Completion
46	136	SD Accounts Payable	2	3	1/1/69	3/1/69
136	152	Program Accounts Payable	2	4	3/1/69	5/1/69
52	62	Program Business Education	4	13	3/1/69	7/1/69
82	86	Program Library	4	4	3/1/69	7/1/69
84	88	Program Audio Visual	4	4	3/1/69	7/1/69
152	168	Implement Accounts Payable	31	3	5/1/69	12/1/71
40	54	SD & CD Science	2	3	5/1/69	7/1/69
154	170	Implement Appropr & Budgetary	30	7	6/1/69	12/1/71
40	56	SD & CD Social Studies	1	1	6/1/69	7/1/69
60	70	Implement Mathematics	29	19	7/1/69	12/1/71
62	72	Implement Business Ed	29	17	7/1/69	12/1/71
54	64	Program Science	2	3	7/1/69	9/1/69
56	66	Program Social Studies	2	4	7/1/69	9/1/69
86	90	Implement Library	29	2	7/1/69	12/1/71
88	92	Implement Audio Visual	29	2	7/1/69	12/1/71
108	120	Implement Census Elem	28	14	8/1/69	12/1/71
66	76	Implement Social Studies	27	5	9/1/69	12/1/71
64	74	Implement Science	27	5	9/1/69	12/1/71
44	106	SD Health	2	3	2/1/70	4/1/70
106	118	Program Health	3	4	4/1/70	7/1/70

Activity Identification		Description	Duration	Man Months	Scheduled Start	Scheduled Completion
46	144	SD Transportation	9	9	5/1/70	2/1/71
46	146	SD Maintenance	6	6	6/1/70	12/1/70
46	148	SD Food Service	6	6	6/1/70	12/1/70
118	130	Implement Health	17	2	7/1/70	12/1/71
46	142	SD Purch & Inventory	4	12	8/1/70	12/1/70
46	140	SD Property	4	4	9/1/70	1/1/71
142	158	Program Purch Inventory	7	18	12/1/70	7/1/71
146	162	Program Maintenance	7	9	12/1/70	7/1/71
148	164	Program Food Service	7	9	12/1/70	7/1/71
140	156	Program Property	6	6	1/1/71	7/1/71
144	160	Program Transportation	6	11	2/1/71	8/1/71
162	178	Implement Maintenance	5	3	7/1/71	12/1/71
164	180	Implement Food Service	5	3	7/1/71	12/1/71
156	172	Implement Property	5	2	7/1/71	12/1/71
158	174	Implement Purch & Inventory	5	7	7/1/71	12/1/71
160	176	Implement Transportation	4	5	8/1/71	12/1/71

Sub-System	Man Months Preceding Initial Implementation	Man Months Following Initial Implementation	Total Man Months Estimated	SYSTEMS/PROGRAMMI FY 1		
	A	B	C	Jan	Feb	Mar
Test Scoring & Analysis	18	8	26			
Math	19	19	38			
Bus Ed	19	17	36			
Science	6	5	11			
Soc Studies	5	5	10			
Advanced CRI	11		11			
Library	7	2	9			
Audio Visual	7	2	9			
Census Elem	42	14	56			
Attendance	18	4	22			1S
Scheduling	25	6	31			
Mark Reptg	18	4	22			
Guidance	30	7	37			2S
Health	7	2	9			
Emp Info	30	8	38			1S
A/P	7	3	10			
Approp & Budg	30	7	37			
Property	10	2	12			
Purch & Inv.	30	7	37			
Trans	20	5	25			
Maint	15	3	18			
Food Serv	15	3	18			
Total Man	389	133	522			4
Utilization Per Month	75%	25%	100%			

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AMMING PERSONNEL SCHEDULE (See Legend Page 137)

FY 1967				FY 1968											
Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
					1S	1S	1S	1S	1S	1S	1P	1P	1P	1P	1P
			2S	3S	3S	3S	3S	3S	2S	2P	1P	1P	1P	1P	1P
1S	1S	1S	1S	1S	1S	1S	1S	1P	1P	1P	1P	2P	1P	1P	1P
		1S	1S	1S	1S	1S	1S	1P	1P	1P	1P	1P	1P	1P	1P
					1S	1S	1S	1S	1S	1S	2P	2P	2P	2P	2P
2S	2S	1S	1S	1S	1S	1S	1S	1S	1S	1S	3P	3P	3P	3P	3P
1S	1S	1S	2S	2S	2S	2S	2S	2P	2P	3P	2P	3P	3P	2P	3
									1S	1S	2S		1S	1S |	1S
4	4	5	7	8	10	10	10	10	10	11	13	13	13	12	13

Sub-System	Man Months Preceding Initial Implementation	Man Months Preceding Initial Implementation	Total Man Months Estimated	SYSTEMS/PROGRAMMING						
								FY 1969		
	A	B	C	July	Aug	Sep	Oct	Nov	Dec	Jan
Test Scoring & Analysis	18	8	26	1P	3P	3P |		2		
Math	19	19	38	1S	1S	1S	1S	1P	1P	1P
Bus Ed	19	17	36				1S	1S	1S	1S
Science	6	5	11							
Soc Studies	5	5	10							
Advanced CRI	11		11			1S	1S	1S	1S	2S
Library	7	2	9						1S	1S
Audio Visual	7	2	9						1S	1S
Census Elem	42	14	56	1P		1P	2P	2P	2P	2P
Attendance	18	4	22	1P |			1	1	1	1
Scheduling	25	6	31	1P	3P	4P	3P |			
Mark Reptg	18	4	22	2P |			1	1	1	1
Guidance	30	7	37	1P	1P |		1	2	1	
Health	7	2	9							
Emp Info	30	8	38	2	2	1				
A/P	7	3	10							1S
Approp & Budg	30	7	37	2S	2S	2S	2P	2P	3P	2P
Property	10	2	12							
Purch & Inv	30	7	37							
Trans	20	5	25							
Maint	15	3	18							
Food Serv	15	3	18							
Total Man	389	133	522	12	12	13	13	13	13	13
Utilization Per Month	75%	25%	100%							

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ING PERSONNEL SCHEDULE (See Legend Page 137)

69							FY 1970											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
							2	2	1	1								
	1P	2P	2P	2P	3P	3P	2	2	2	2	2	2	1	1	1	1	2	1
	1S	3S	3P	3P	3P	3P	1P	2	2	2	2	2	1	1	1	1	1	1
					1S	2S	2P	1P			1	1	1	1	1			
						1	2P	2P			1	1	1	1			1	
S	2S	1S	1S	1S	1S	1S												
S	1S	1S	1P	1P	1P	1P			1	1								
S	1S	1S	1P	1P	1P	1P			1	1								
P	2P	1P	1P	1P	1P	1P	1P			2	2	2	2	2	2	2		
	1																	
							2	2	2									
	1																	
							1	1	1									
																2S	2P	1P
	1S	2S	2P	2P							1	1	1					
P	2P	2P	2P	2P	2P								1	1	1	1	1	1
																	1S	1S
																		1S
																		1S
3	13	13	13	13	13	13	13	12	10	9	9	9	7	8	8	7	7	7

Sub-System	Man Months Preceding Initial Implementation	Man Months Following Initial Implementation	Total Man Months Estimated	SYSTEMS/PROGRAMMING PERSON				
				F				
	A	B	C	July	Aug	Sep	Oct	Nov
Test Scoring & Analysis	18	8	26					
Math	19	19	38					
Bus Ed	19	17	36					
Science	6	5	11					
Soc Studies	5	5	10					
Advanced CRI	11		11					
Library	7	2	9					
Audio Visual	7	2	9					
Census Elem	42	14	56					
Attendance	18	4	22					
Scheduling	25	6	31					
Mark Reptg	18	4	22					
Guidance	30	7	37					
Health	7	2	9	1	1			
Emp Info	30	8	38					
A/P	7	3	10					
Approp & Budg	30	7	37	1				
Property	10	2	12			1S	1S	
Purch & Inv	30	7	37		3S	3S	3S	
Trans	20	5	25	1S	1S	1S	1S	
Maint	15	3	18	1S	1S	1S	1S	
Food Serv	15	3	18	1S	1S	1S	1S	
Total Man	389	133	522	5	7	7	7	
Utilization Per Month	75%	25%	100%					

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PERSONNEL SCHEDULE (See Legend Page 137)

FY 1971									FY 1972					
Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1S	1S	1S	1P	1P	1P	1P	1P	1P	1	1				
3S	3S	3P	3P	3P	3P	2P	2P	2P	2	2	1	1	1	
1S	1S	1S	1S	1P	2P	2P	2P	2P	2P	2	2	1		
1S	1S	1P	1P	1P	1P	1P	2P	2P	1	1	1			
1S	1S	1P	1P	1P	1P	1P	2P	2P	1	1	1			
7	7	7	7	7	8	7	9	9	7	7	5	2	1	

D. Systems/Programming Personnel Schedule

1. Quantity in block indicates man months.
2. (S) in block indicates system analyst.
3. (P) in block indicates programmer.
4. Totals on bottom indicate total personnel scheduled for for each month.
5. Columns on left indicate:
   - A. Man months required per activity.
   - B. Man months required per activity following initial implementation.
   - C. Total man months.
6. Vertical block indicates initial implementation date for each sub-system.

XII. EXPENSES AND FINANCING.

A. Philosophy.

1. Membership Dues. While it is anticipated that some outside funding could be obtained to help underwrite a portion of the costs of developing coordinated data processing services, the participating schools must assume a significant portion of the development costs. They must also plan to pay for the continuing costs of the services.

We recommend that annual membership dues to cover costs be established according to the number of pupils in the school system. A separate dues schedule should exist for the non-public schools because the nature of their present service requirements differs from that of the public schools. Suggested dues schedules are set forth in a subsequent section of this chapter.

The governing body of the organization would change the dues from time to time in order to more closely reflect costs.

The concept of service prices is described below. While schools could be permitted to purchase selected services at the prevailing prices, we do not believe this would be a satisfactory initial arrangement as compared to the membership dues concept.

Computer reruns will be necessary from time to time. We recommend that the cost of reruns due to errors made by the user, be charged in addition to the membership fee.

Certain schools will not join the project immediately. We recommend that all schools joining after fiscal 1967 be required to pay back dues based upon enrollment figures for the prior periods or a prorata share of the development costs as determined by the governing body.

2. Service Prices. We also recommend that prices be established for individual services. Several reasons exist for this including at least the following:
    (a) The cost accounting system recommended will benefit by having cost/income relationships.
    (b) Individual schools should make cost/benefit comparisons between an existing system and potential data processing services.
    (c) An annual comparison should be made for each participating school between membership dues and the cumulative service price value. This comparison should serve to motivate schools to increase their utilization of services and/or to stimulate improved availability of services from the data processing center.

(d) Instances will arise wherein the governing body may elect to provide a single service to a non-member school. Availability of service prices will facilitate arrangements.

(e) Comparisons can be made with prices available from other sources.

It should be understood that the cash outlays of the participating schools would ordinarily be based on the membership dues, not on service prices.

3. Costs Covered by Membership Dues or Service Prices.

Costs of many types should be covered by the dues or prices. This should be clearly understood when making any comparisons with other prices or expenditures for seemingly similar data processing services. The dues or prices indicated in this report cover at least the following types of costs:

(a) Central hardware
(b) Operating personnel costs
(c) Systems design and programming
(d) Program maintenance
(e) Curriculum development and implementation
(f) In-service education
(g) Educational research
(h) Data transportation services
(i) Administration

Certain costs associated with data processing services are not included in the membership dues. These include the costs of communication lines and terminals, keypunches, add punches, personnel, etc. that would be physically on the premises of the member school. Schools should also pay directly for forms that are designed for their specific use. Test Scoring services would not include the cost of booklets or extensive advisory services on testing programs.

4. Grants. Sources of funds beyond an operational grant for coordinated data processing services should be sought. Various research or developmental efforts may be of a nature to warrant grant funding.

B. Basis of Membership Dues.

Suggested dues for the public schools are set forth on the basis of covering the forecasted expenses through fiscal year 1972. The dues schedule would have to be revised if no outside funding were available.

Dues are based on grades K-12 enrollment because of simplicity. Separate dues for grades K-6 and 7-12 could be established if the schools so desired, but it probably would not materially effect the total expenses to an individual school district.

A separate dues schedule was developed for non-public schools. Since the majority of non-public schools are organized in separate schools involving grades 1-8 and 9-12 respectively, we developed a dues schedule for each. Page 22 of the appendix indicates the methods used to establish the non-public dues schedule. The guiding principal was that of establishing dues on the basis of forecasted data processing service usage, so that the public and non-public schools do not subsidize each other.

Key assumptions in establishing non-public dues are as follows:

1. Non-public schools would not require certain elements of secondary Student Information systems i.e., annual attendance and transportation report.
2. Non-public schools would not require certain elements of the Census/Elementary sub-system i.e., census, annual attendance and transportation report.
3. Non-public schools would not require any of the Administrative/Financial sub-systems.

Those non-public schools with grades 1-8 would have membership dues that are equal to thirty six percent of those paid by the K-12 public schools. Non-public schools with grades 9-12 would have membership dues that are equal to ninety seven percent of those paid by the K-12 public schools. Use of different assumptions or development of cost records in connection with implementation could alter the above percentages.

Enrollments as of October 1st of each year could be used. Partial or full payment should occur at a time that satisfies the cash requirements of the data processing center.

C. Basis of Service Prices.

Service prices were developed by obtaining prevailing prices for similar services and using our own estimates of future usage. The cost accounting system should develop data that would be the basis for making appropriate revisions to these prices. Prices should be developed at a later time for Instructional Uses other than test scoring,for the Materials Information System and the unpriced sub-systems in Administrative/ Finance.

D. Schedule of Membership Dues.

These dues will be subject to adoption and change by action of the governing body. We did not estimate hardware and allied costs that would occur with extensive Instructional Uses. Widespread adoption of such uses would substantially increase the membership dues by FY 1972 as well as the outlays that individual schools might make for on-premise equipment, personnel, etc.

The recommended initial membership dues per pupil are as follows:

	FISCAL YEARS					
	1967	1968	1969	1970	1971	1972
Public Schools K-12	$.75	$.75	$2.00	$3.00	$4.50	$5.00
Non-public 1-8	.27	.27	.72	1.08	1.62	1.80
Non-public 9-12	.73	.73	1.94	2.91	4.37	4.85

The above schedule is based on a forecast of the students involved in the coordinated project in various fiscal years. No growth is assumed in the new member student population in subsequent years. The forecast is as follows:

(Thousands Omitted)

	New Members	Cumulative
Fiscal 1967	110	-
1968	40	150
1969	30	180
1970	10	190
1971	10	200
1972	5	205

Any material variance from the above forecast or expenses as forecast in the budget may necessitate a revision of the membership dues by the governing body.

E. Schedule of Service Prices.

These prices are preliminary in character and subject to revision by the governing body prior to and after the implementation of services.

Name of Service	Public School Price/Basis	Non Public School Price/Basis
1. Secondary Student Information A. Attendance B. Sectioning C. Mark Reporting	\$3.50 per annum per secondary pupil	\$2.50 per annum per secondary pupil
2. Census/Elementary A. Elementary Attendance B. Elementary Mark Reporting	\$1.50 per annum per secondary pupil	\$.75 per annum per elementary pupil
3. Guidance Sub-System	\$1.00 per annum per secondary pupil	Same as Public
4. Employee Information	\$12.00 per annum per regularly employed personnel	Same as Public[1]
5. Accounts Payable and Appropriation and Budgetary Accounting	\$.75 per annum per K-12 pupil	Same as Public[1]
6. Test Scoring/Analysis	\$.20 per test scored	Same as Public

[1] Determination of the membership fee for non-public schools assumed that these services would not be utilized by non-public schools. Should they choose to use them, the membership fee should be increased.

As other specific sub-systems or applications are designed, appropriate pricing will be developed for them. Page 21 in the appendix indicates the availability rate of these data processing services.

F. Table of Gross Membership Dues.

The following table illustrates the gross membership dues that would be paid by various types and sizes of schools on the basis of forecasts set forth earlier in this chapter.

Type of School & Population	Estimated Gross Amount Based on Student Population[1]					
	Fiscal Years					
	1967	1968	1969	1970	1971	1972
Public Schools (K-12)						
3,000	$ 2,250	$ 2,250	$ 6,000	$ 9,000	$13,500	$ 15,000
5,000	3,750	3,750	10,000	15,000	22,500	25,000
10,000	7,500	7,500	20,000	30,000	45,000	50,000
15,000	11,250	11,250	30,000	45,000	67,500	75,000
20,000	15,000	15,000	40,000	60,000	90,000	100,000
Non-Public (1-8)						
300	81	81	216	324	486	540
500	135	135	360	540	810	900
800	216	216	576	864	1,296	1,440
1,000	270	270	720	1,080	1,620	1,800
1,300	351	351	936	1,404	2,106	2,340
1,500	405	405	1,080	1,620	2,430	2,700
Non-Public (9-12)						
500	365	365	970	1,455	2,185	2,425
800	584	584	1,552	2,328	3,496	3,880
1,000	730	730	1,940	2,910	4,370	4,850
1,300	949	949	2,522	3,783	5,681	6,305
1,500	1,095	1,095	2,910	4,365	6,555	7,275

[1] The table does not take into account normal growth that is likely to occur in the student population over the span of years indicated.

G. Member On-Premise Expenses.

Certain other expenses would be incurred by member schools beyond the dues. These would include:

1. Education Information System coordinator. The duties of this person have been elsewhere described.
2. Keypunch and control personnel. These personnel would key, verify and control appropriate data being transmitted to the data processing center.
3. Equipment. A teletype or allied terminal is specified for Appropriation and Budgetary Accounting. Other equipment such as add punches, keypunches, sorters etc. will be required on the premise of most schools. Data phone and communication line costs would also be borne by the participating school.
4. Overhead. Space, heat, light, maintenance and other costs of this type will be incurred by schools. However, they have not been set forth in the estimates below.
5. One time. Certain expenses of temporary personnel, remodeling quarters, freight, cabinets, etc. No attempt has been made to itemize these expenses for member schools.

The following table is presented to represent the estimated on-premise expenses that school systems would incur. Year of forecast selected is fiscal 1971.

ESTIMATE OF MEMBER ON-PREMISE EXPENSES *

Fiscal 1971

Type of School & Population	EIS Coord[1]	Keypunch & Control[2]	Equip[3]	Total
Public Schools (K-12)				
3,000	$ 3,000	$ 3,375	$ 4,000	$10,375
5,000	5,000	5,625	4,000	14,625
10,000	10,000	11,250	5,000	26,250
15,000	15,000	17,100	6,000	38,100
20,000	20,000	22,500	7,000	49,500
Non-Public (1-8)				
300	100	150	30	280
500	165	225	45	435
800	265	360	70	695
1,000	330	450	90	870
1,300	430	585	120	1,135
1,500	495	675	135	1,305
Non-Public (9-12)				
500	500	540	750	1,790
800	800	900	750	2,450
1,000	1,000	1,125	750	2,875
1,300	1,300	1,465	750	3,515
1,500	1,500	1,690	750	3,940

* Estimate does not include the expenses that may be associated with instructional uses. Also assumes that significant progress will have been made in using optical scanning or similar technology for data entry.

1 Estimated salary expense for non-public schools assume lay personnel expenses as follows:

A. Grades 1-8 at $.32 per pupil

B. Grades 9-12 at $1.00 per pupil

Salary for public schools is estimated at $1 per pupil K-12.

2 Basis is that every one thousand pupils (K-12 public or 9-12 non-public) requires .25 keypunch and control personnel at $4,500.00 per year. Also that every one thousand pupils (1-8 non-public) requires .1 keypunch and control personnel at $4,500.00 per year. Non-public schools would probably undertake these activities jointly.

3 Basis is that non-public (1-8) would make joint use of on-premise equipment. Equipment cost is assumed to be 20% of keypunch and control cost for non-public (1-8) schools. We have assumed that non-public (9-12) would each have a printing keypunch on their premises. The basis for public schools is our estimate that assumes one $3,000 per year terminal and one keypunch or verifier per keypunch control person.

XIII BUDGET

On Schedules 1 and 2 in this chapter, forecasts of income and expenses are projected over a six year period through fiscal year 1972. This method of projecting income and expenses is believed by us to be most relevant to many important factors to this project. While it has been specified that schools with an aggregate K-12 population of 100,000 should indicate their intent to participate in this project before submission of an operational grant application, the forecast assumes that 205,000 K-12 students will be utilizing this service by fiscal year 1972.

A. Basis of Membership Income Forecast.

We have assumed that public schools with 110,000 K-12 children would participate in the project before the end of fiscal 1967. We have also assumed that additional schools with students numbering 95,000 would participate by fiscal 1972. We have not assumed any growth in the student population of the schools which have previously joined the project.

For purposes of this forecast, we have not included any non-public schools. We believe it is reasonable to assume that many of these schools will join this project. Their joining will probably not materially effect the membership dues of the public schools.

Any failure to add the number of schools to the system according to Forecast of Membership Income Schedule will necessitate that the costs incurred by the data processing center be reduced or that an adjustment be made to the existing membership dues schedule.

B. Basis of Expense Forecast.

Expenses were developed in consultation with or have been reviewed by many parties in the educational or data processing field. Material alteration to the plans set forth in this report could result in a similar effect on expenses.

Expense forecasts do not take into account widespread adoption of instructional uses.

Purchase of computer hardware is not provided for in the forecast. Such a possibility should be explored in the course of selecting a manufacturer.

While Alternative B of renting hourly data center time is a possibility for the first year of providing operational services, we have assumed for purposes of the expense forecast that such an arrangement could not be worked out.

C. Summary of Income and Expense Forecast.

Schedules 1 and 2 provide complete detail of forecasted income and expenses. A summary is presented in the following schedule:

	Fiscal Year (Thousands Omitted)					
Item	1967	1968	1969	1970	1971	1972
Membership Income (See Schedule 1)	$ 83	$ 143	$ 405	$ 605	$965	$1,080
Expenses (See Schedule 2)						
Personnel	40	266	418	525	543	584
Hardware	-	35	133	175	198	235
Other	34	143	195	206	205	236
Total Expenses	74	444	746	906	946	1,055
Surplus/Deficit [1]	9	(301)	(341)	(301)	19	25

[1] It is anticipated that federal funds under P.L. 89-10 would be a source to cover the above deficit.

FORECAST OF MEMBERS

FISCAL YEARS 1967

	Dues/Pupil		Schools Joining	Back Dues For New Members Thous. Omitted		Cumulative	
	Yearly	Cum.	(Pupils)	Basis	Dollars	Membership	1
Membership Dues (K-12)							
1967	$ .75		110,000				$8
1968	.75	$ 1.50	40,000	40 @	.75 =$30	150,000	
1969	2.00	3.50	30,000	30 @	1.50 =$45	180,000	
1970	3.00	6.50	10,000	10 @	3.50 =$35	190,000	
1971	4.50	11.00	10,000	10 @	6.50 =$65	200,000	
1972	5.00	16.00	5,000	5 @	11.00 =$55	205,000	
							$8

SCHEDULE 1.

MEMBERSHIP INCOME

RS 1967 TO 1972

	Income Forecast for the Fiscal Year Ended					
ive hip	1967	1968	1969	1970	1971	1972
	$82,500					
00		$142,500				
00			$405,000			
00				$605,000		
00					$965,000	
00						$1,080,000
	$82,500	$142,500	$405,000	$605,000	$965,000	$1,080,000

FORECAST OF EXPEN

FISCAL YEARS 1967 t

Expense Classification	Starting Annual Salary Range ± 10%	Starting Number of Personnel First Year No.	FTE*	1967 FTE	1967 Dollars	1968 FTE	1968 Dollars	Expense Fo FT
Personnel								
Administration								
Director of Education Services	25,000	1		.1	2,500	1	25,000	1
Asst. Director of Educ. Svcs	20,000	1				1	20,000	1
Staff Consultants								
Educational Research	14,000	1		.3	4,200	1.0	14,000	1
Mathematics	14,000	1				.8	11,200	1
Bus. Educ.	14,000	1				.8	11,200	1
Social Studies	14,000	1				.3	4,200	1
Science	14,000	1				.3	4,200	1
Advanced CRI	16,000	1				.3	4,200	1
Materials Inform Sys	14,000	1				.3	4,200	1
Systems/Programming								
Manager Systems Programming	16,000	1						
Systems Analysts	13,000	4	.4	1.6	20,800	4.	52,000	
								1

SCHEDULE 2
Page 1 of 5

EXPENSES

967 to 1972

nse Forecast for the Fiscal Year Ended

	1969		1970		1971		1972	
s	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars
00	1	25,000	1	25,000	1	25,000	1	25,000
00	1	20,000	1	20,000	1	20,000	1	20,000
00	1	14,000	1	14,000	1	14,000	1	14,000
00	1	14,000	1	14,000	1	14,000	1	14,000
00	1	14,000	1	14,000	1	14,000	1	14,000
00	1	14,000	1	14,000	1	14,000	1	14,000
00	1	14,000	1	14,000	1	14,000	1	14,000
00	1	16,000	1	16,000	1	16,000	1	16,000
00	1	14,000	1	14,000	1	14,000	1	14,000
			1	16,000	1	16,000	1	16,000
00	4	52,000	4	52,000	4	52,000	4	52,000

Expense Classification	Starting Annual Salary Range ± 10%	Starting Number of Personnel First Year		1967		1968	
		No.	FTE*	FTE	Dollars	FTE	Doll
Programmers	9,000	2	.4	.8	7,200	6	54,
Operations							
Manager of Operations	12,000	1				.5	6,
Computer/Machine Operators	8,000	1				.2	1,
Keypunch Operators	5,000	1				.5	2,
Transportation Personnel	4,000	1				.1	
Control Personnel	4,500	1				1.	4,
Librarian	5,000	1				.1	
Secretary/Stenographer/Clerk	5,000	1		.4	2,000	2.0	10,
Accountant	8,000	1				.5	4,
Services/Conversion							
Services Coordinators	13,000	1				.5	6,
Conversion Coordinators	11,000	1					
Assistant Conversion Coordinator	9,000	1				.3	2,
					36,700		242,
Annually 4% Salary Adjustment (on prior year unadjusted)					-		1,
					36,700		244,
Personnel Benefit Program (9% of Adjusted salary)					3,300		21,
Total Personnel & Expenses				3.2	40,000	21.5	266,

* Full Time Equivalent Personnel

	1969		1970		1971		1972	
lars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars
4,000	6	54,000	6	54,000	1	54,000	6	54,000
6,000	1	12,000	1	12,000	1	12,000	1	12,000
1,600	3	24,000	6	48,000	7	56,000	9	72,000
2,500	4	20,000	6	30,000	7	35,000	7	35,000
400	1	4,000	3	12,000	3	12,000	4	16,000
4,500	2	9,000	5	22,500	5	22,500	6	27,000
500	1	5,000	1	5,000	1	5,000	1.5	7,500
0,000	2	10,000	4	10,000	4	20,000	6	30,000
4,000	.7	5,600	1	8,000	1	8,000	1	8,000
6,500	1	13,000	1	13,000	1	13,000	1	13,000
	1	11,000	1	11,000	1	11,000	1	11,000
2,700	1	9,000	2	18,000	2	18,000	2	18,000
2,900		373,600		466,500		479,500		516,500
1,470		9,700		14,900		18,660		19,180
4,370		383,300		481,400		498,160		535,680
1,993		34,500		43,300		44,800		48,200
6,363	36.7	417,800	51	524,700	53	542,960	59.5	583,880

Expense Classification	1967		1968		
	FTE	Dollars	FTE	Dollars	FT
Hardware					
Rental of Data Center Time for testing/scheduling		-		10,000	
Rental of Data Center Time for Instructional uses		-		7,500	
Rental of On-Premises Equipment (Arrive May 1968)		-		17,500	
Addition of Communication Capability (Arrive April 1969)		-		-	
Total Hardware Expenses				35,000	

1969		1970		1971		1972	
FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars
	10,000		15,000		18,000		20,000
	7,500		15,000		25,000		50,000
	108,000		115,000		120,000		125,000
	7,500		30,000		35,000		40,000
	133,000		175,000		198,000		235,000

Expense Classification	Basis	1967		1968	
		FTE	Dollars	FTE	Dollars
Other Expenses					
Housing	$4.50/sq ft incl. heat,light,custodial				
Hardware	& Maint. 2,500 sq ft. (17% for 1st yr, 2mo)		-		1,900
Personnel	150 sq ft per full time equiv empl.		870		14,500
Dues, Subscriptions & Books			500		1,000
Printing/Binding Expenses	In-service publications, procedure manuals, newsletter, etc.		1,000		7,500
Postage			300		3,000
Telephone Services					
Conversation	$300/per full time equiv. employee		960		6,450
Professional/ Consulting Service	Legal,auditing, accounting educational research, editorial, data processing and curriculum development		15,000		40,000
Travel	$300-/trip; 1.5 trips per annum per FTE		1,440		9,675
Forms & Supplies	data processing forms principally		3,000		7,500
In-service education	Visiting lecturer's, site visits, space rental, published material, classroom aids, etc.		2,000		10,000
Recruiting/ Moving Expenses	$1,000/incremental FTE		3,200		18,300
Freight			500		3,000
Operation of Transportation Vehicle	8¢ mile, 40,000 miles/ yr., per trans. emp.				

		1969		1970		1971		1972
llars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars
1,900		11,250		11,250		11,250		11,250
4,500		24,770		34,425		36,375		40,165
1,000		1,200		1,500		2,000		2,500
7,500		10,000		12,000		16,000		20,000
3,000		4,000		5,000		6,000		7,000
6,450		11,000		15,300		15,900		17,850
0,000		35,000		10,000		7,500		7,500
9,675		16,500		22,950		23,850		26,775
7,500		35,000		45,000		55,000		60,000
0,000		12,000		14,000		16,000		18,000
8,300		15,200		14,700		2,000		6,500
3,000		1,500		1,000		500		1,000
		3,200		9,600		9,600		12,800

Expense Classification	Basis	1967 FTE	1967 Dollars	1968 FTE	1968 Dollars	FT
Capital Expenditures	Leasehold improvements, desks, chairs, typewriters, dictation equipment, room dividers		5,000		20,000	
Total Other Expenses			33,770		142,825	
Total Expenses			73,700		444,188	

	1969		1970		1971		1972	
rs	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars
00		15,000		10,000		3,500		5,000
25		195,620		206,725		205,475		236,340
88		746,420		906,425		946,435		1,055,220

XIV. SYSTEMS DESIGN REPRESENTATIONS

Phase I, II and III Questionnaires described in some detail the nature of over ninety data processing services (applications) that might be beneficial to schools.

As part of the descriptions selected input/output formats were suggested as well as general descriptions of how the applications would function. The interested reader can write or call ERDC, Burton Hall, University of Minnesota, Minneapolis to obtain a copy of the questionnaires.

We anticipate that the various systems/programming personnel and technical committees will make use of the data contained in the questionnaires as they begin design activities.

We have below created representations of two systems or sub-systems that are part of this project. They are intended only to illustrate our broad concepts of the systems design.

A. Student Information System.

1. Student Master Record.

Such a record for an individual student could have great variance with respect to record size and content depending on the definitions established by participating schools. We believe such a record for an individual student if developed beginning in kindergarten and terminated in grade twelve could have in excess of 30,000 characters if significant amounts of anecdotal or narrative data are included. Coding structures, elimination of narrative data and file segmenting can have the effect of creating a more workable record length.

Data items that should be considered for inclusion in a student master record would include at least the following:

Student Identification No. (Optional)
Student Social Security No.
School Bldg. No.
Name
Address
City State
Zip Code
Sex
Birth Date
Entering Class Year
Geographic Location of Residence
Current Bus No.
Transportation Status
Current Counselor No.
Current Teacher No. of Elementary
Absences by Day of Week - Current Year
Times Tardy - Current Year
Teacher Identification K-12
Subject Numbers & Final Marks K-12
Subject Numbers and Current Year Marks
Cumulative Honor Points
Cumulative Credits
Number of Absences Prior Years K-12
Times Tardy Prior Years K-12
Standardized Test, Sub Test Scores, Percentile
Behavior Ratings K-12
Cocurricular Activities K-12
Vacination History and Status
Physical Impairments
Date of Last Audio Exam.
Date of Last Eye Exam.
Date of Last Physical Exam.
Date of Last Mantoux Test and Result
Student Vocational Interests
Student Non-Vocational Interests
Parents Marital Status
Fathers Name

Mothers Name
Parental Address (if different than students)
Fathers Birth Year
Mothers Birth Year
Birth years and Sec of Siblings
Fathers Occupation, Employer and Phone No.
Mothers Occupation, Employer and Phone No.
Education Completed by Father
Education Completed by Mother

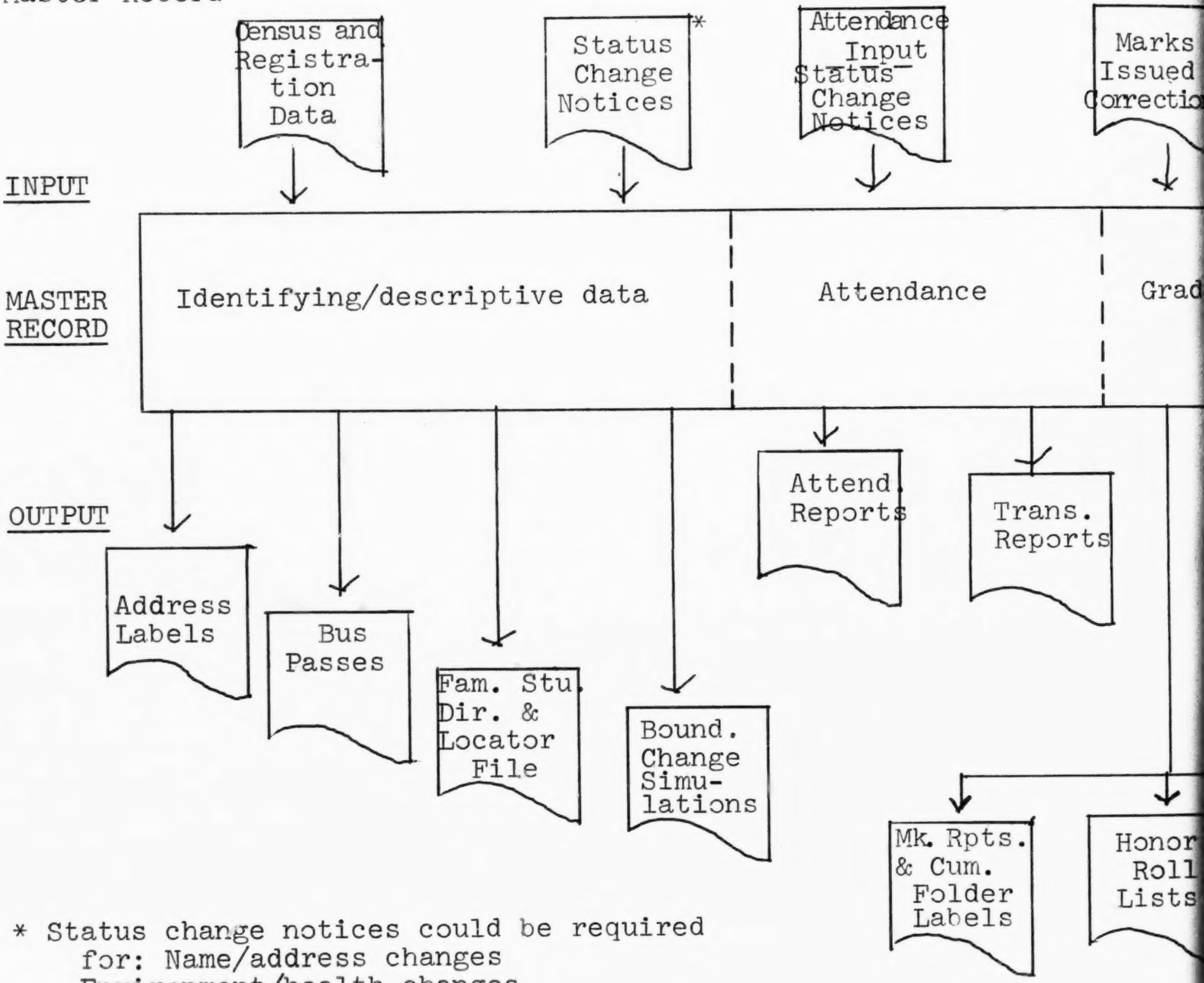
2. Student Information System Input/Output.

   On the following page is a representation of the different types of data that would be interacting in the Student Information System.

STUDENT INFORMAT

INPUT/OUT

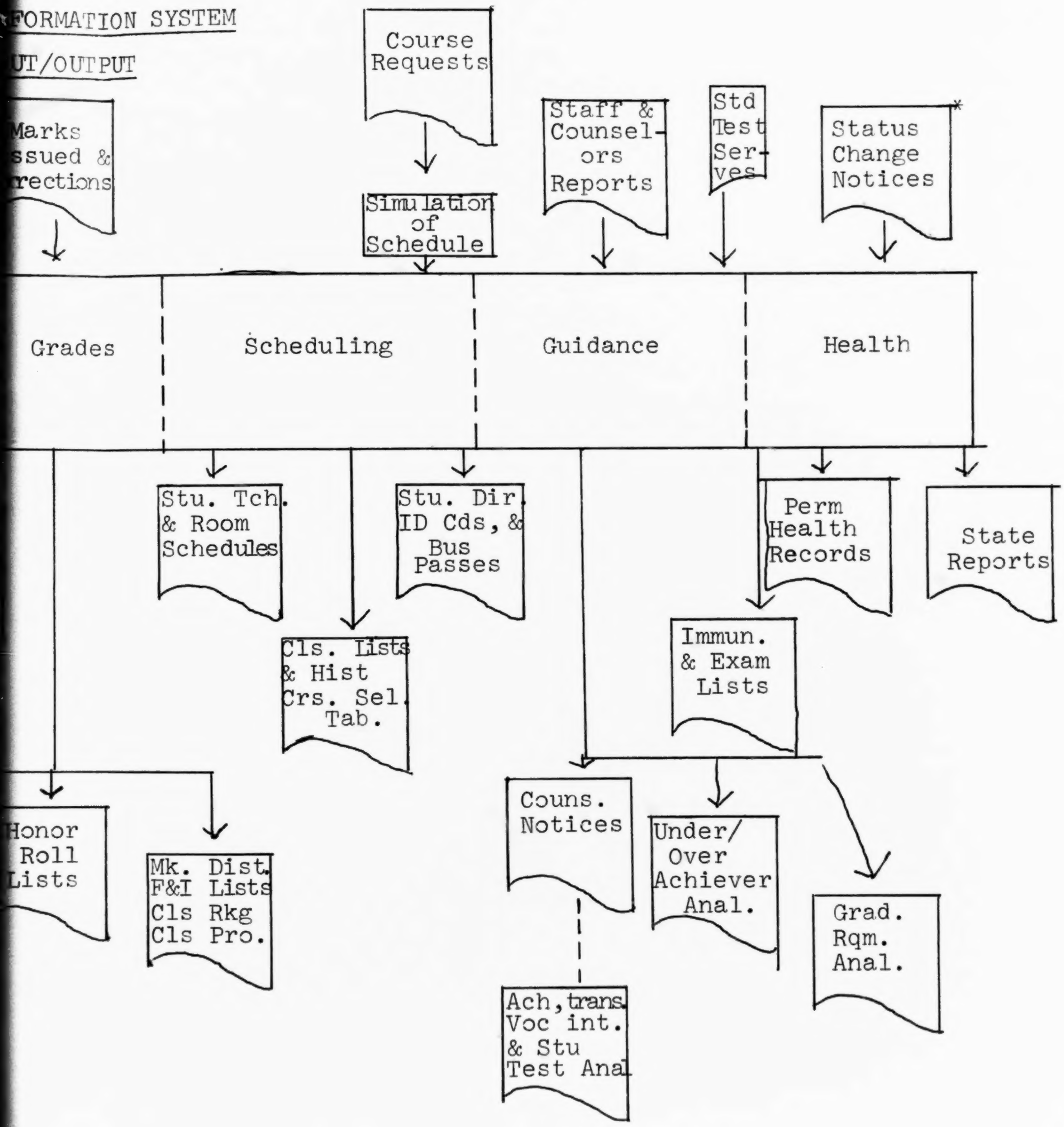
Student Information System
Master Record


Census and Registration Data
Status Change Notices *
Attendance Input
~~Status Change Notices~~
Marks Issued Correctio
INPUT
MASTER RECORD
Identifying/descriptive data
Attendance
Grad
OUTPUT
Address Labels
Bus Passes
Fam. Stu. Dir. & Locator File
Bound. Change Simulations
Attend. Reports
Trans. Reports
Mk. Rpts. & Cum. Folder Labels
Honor Roll Lists

* Status change notices could be required
for: Name/address changes
Environment/health changes

FORMATION SYSTEM

UT/OUTPUT


Marks
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Course
Requests
Simulation
of
Schedule
Staff &
Counsel-
ors
Reports
Std
Test
Ser-
ves
Status
Change
Notices
*
Grades
Scheduling
Guidance
Health
Stu. Tch.
& Room
Schedules
Stu. Dir.
ID Cds, &
Bus
Passes
Perm
Health
Records
State
Reports
Cls. Lists
& Hist
Crs. Sel.
Tab.
Immun.
& Exam
Lists
Honor
Roll
Lists
Mk. Dist.
F&I Lists
Cls Rkg
Cls Pro.
Couns.
Notices
Under/
Over
Achiever
Anal.
Grad.
Rqm.
Anal.
Ach, trans.
Voc int.
& Stu
Test Anal

B. Employee Information Sub-system.

1. Student Master Record.

A master record of 500 to 2,000 characters could be created in connection with this sub-system. Data contained in the record could include at least the following:

Name
Spouse Name
Address
Telephone number
Birthdate
Sex
Date of employment
Building
College of undergraduate degree
Year of graduation
Majors
Minors
History of courses beyond most recent degree
College of graduate degree
Year of graduate degree
Major filed of graduate degree
Certificate number
Certificate expiration date
Extra curricular activities
Salary history
Current salary
History of subjects taught
Subjects currently taught
Social Security number
Marital status
Number of dependents
Medical report status
Position code
Salary distribution codes
Termination date and reason code
Placement on salary schedule
Sick leave data
Personal leave data
Leave of absence data
Retirement number and plan
Tax sheltered annuity
Non-teaching experience
Voluntary payroll deductions

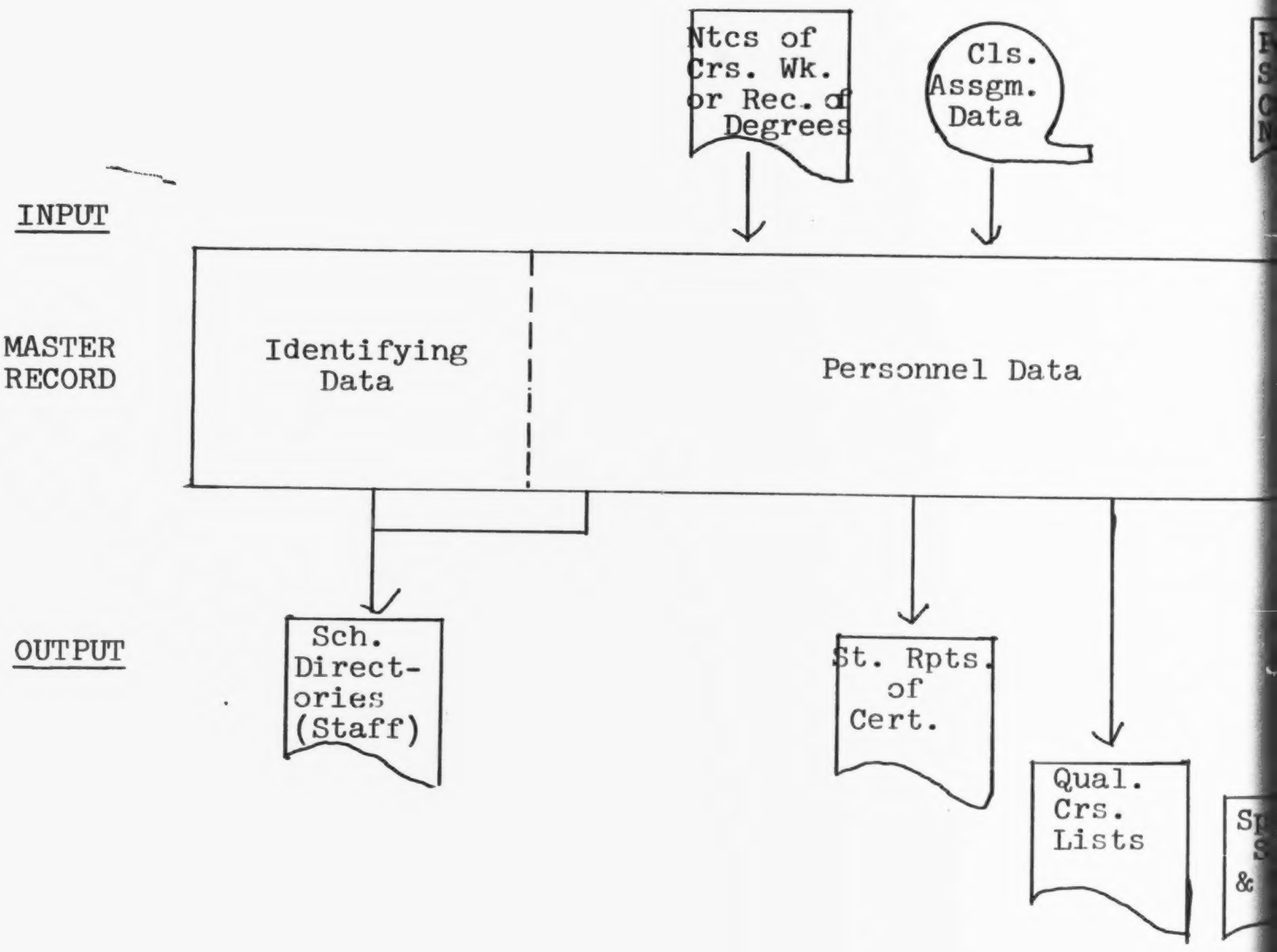
Federal exemptions
State exemptions
Year to date data

2. Employee Information Sub-system Input/Output.

On the following page is a representation of the different types of data that would be interacting in the Employee Information Subsystem.

EMPLOYEE INFOR

INPUT/


Ntcs of Crs. Wk. or Rec. of Degrees
Cls. Assgm. Data
INPUT
MASTER RECORD
Identifying Data
Personnel Data
OUTPUT
Sch. Directories (Staff)
St. Rpts. of Cert.
Qual. Crs. Lists
Sp
&

INFORMATION SYSTEM

NPUT/OUTPUT

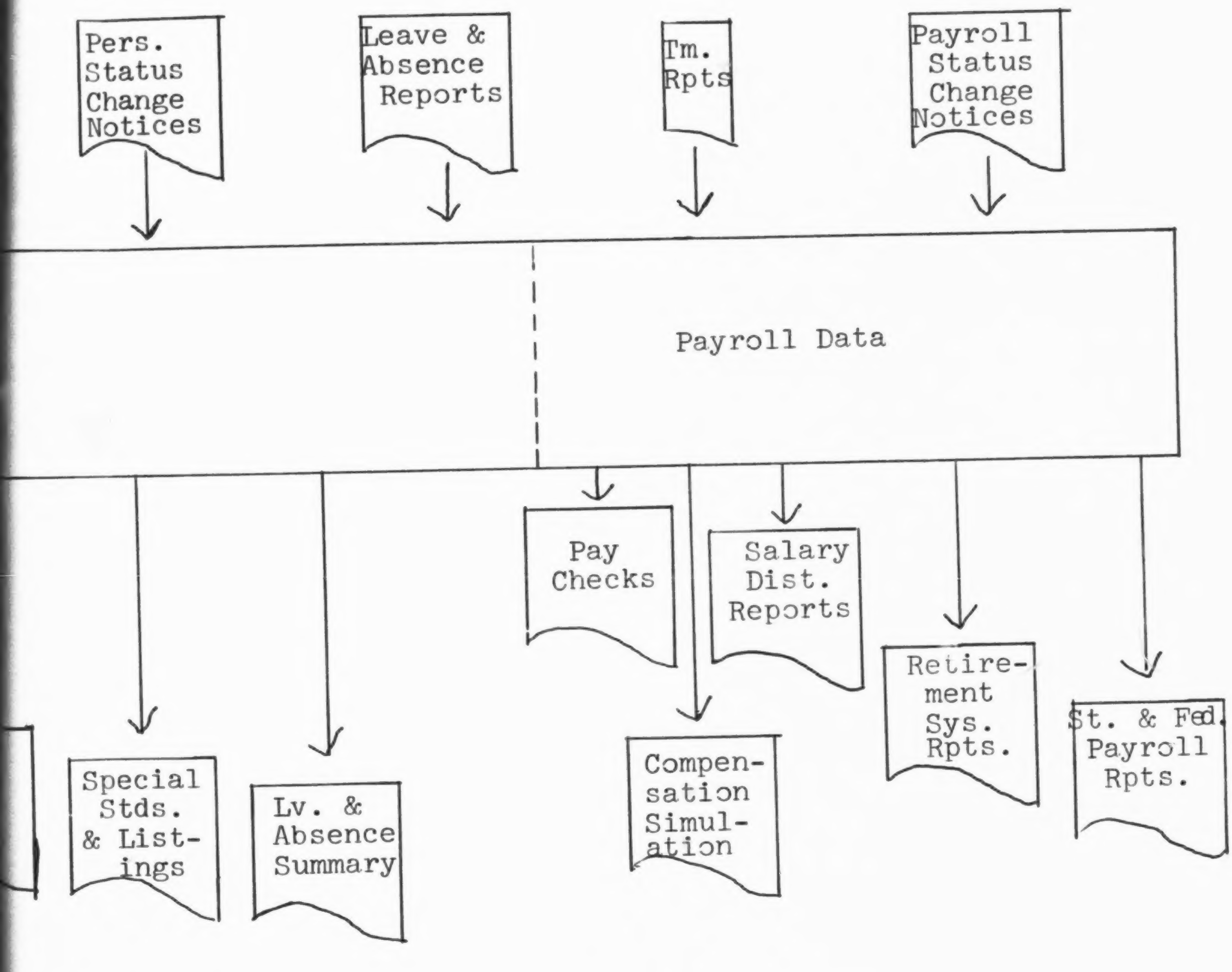

Pers. Status Change Notices
Leave & Absence Reports
Tm. Rpts
Payroll Status Change Notices
Payroll Data
Pay Checks
Salary Dist. Reports
Retire-ment Sys. Rpts.
St. & Fed. Payroll Rpts.
Compen-sation Simul-ation
Special Stds. & List-ings
Lv. & Absence Summary

EXHIBIT A-1

TABLE OF STUDENT INFORMATION SUB-SYSTEM PRIORITIES

Below are listed the six sub-systems of the Student Information System, the Materials Information System and their component applications. Some applications are listed independent of a sub-system and are understood to be generally associated with the overall system.

Phases 1, 2 & 3 are indicated as columnar headings. These do not imply a particular time period; rather the relative sequence of systems design, programming and implementation of the applications within a particular sub-system. With some sub-systems, the three phases might extend over a period of less than one year. In other instances the three phases might span up to 5 years.

Within each sub-system, the applications are listed in benefit rating sequence from top to bottom. This should be an additional guide in resolving any priority conflicts within a sub-system, though probably less important than guidance available at that time from school personnel participating in the cooperative venture.

Sub-system Interface indicates other sub-systems or applications having interface with the application listed. Footnote 1 indicates the initial for sub-system identification. A name refers to another specific application sub-system, or system. SD, P & I refer to Systems Design, Programming and Implementation respectively.

EXHIBIT A.

	Sub-System Interface [1]	Phase 1			Phase 2			Phase 3		
		SD	P	I	SD	P	I	SD	P	I
1. Student Info. System										
Behavior Trait Posting [2]		X				X	X			
Student/Family Info & Background		X				X	X			
Envelope Addressing								X	X	X
Student Activity Posting [2]		X				X	X			
Reading Pattern Inventory								X	X	X
Teacher Parent Opinion Surveys								X	X	X
Bus Passes								X	X	X
2. Census/Elem. Student Info.										
Tabulations		X	X	X						
Class Lists	S	X				X	X			
Scheduling Teacher Parent Conferences		X				X	X			
Kindergarten Roundup Mailing		X				X	X			
Family Student Dir & Locater File	S	X				X	X			
Boundary Line Determination		X				X	X			
Reading Pattern Inventory	S							X	X	X
Student/Class Profile	S	X							X	X

---

[1]
A = Attendance Sub-system
CE = Census/Elem. Student Info Sub-system
G = Guidance Sub-system
H = Health Sub-system
M = Mark Reporting Sub-system
S = Scheduling Sub-system
T = Test Scoring

[2] These potential services are included as part of the design of the student information system because they may be a requisite to an electronic student record. Apart from that consideration recording of this on mark sense or porta-punch cards ordinarily could reduce the time to record this data on a permanent record card by producing a label to be affixed to it.

	Sub-System Interface [1]	Phase 1			Phase 2			Phase 3		
		SD	P	I	SD	P	I	SD	P	I
3. Attendance Sub-system										
Elem. Annual Attendance Report		X				X	X			
Elem. Periodic Attendance Accum.	M	X				X	X			
Secondary Annual Attendance Report		X	X	X						
Secondary Periodic Attendance Accum.	M	X	X	X						
Annual Transportation Report-Sec.	Trans.	X				X	X			
Annual Transportation Report-Elem.	Trans.	X				X	X			
4. Scheduling Sub-systems										
Student Sectioning/Schedules		X	X	X						
Teacher Schedules [3]		X				X	X			
Room Schedules [3]		X				X	X			
Class Lists	CE	X	X	X						
Conflict Matrix		X	X	X						
Course Tally		X	X	X						
Student Directory	CE	X	X	X						
Student I.D. Cards		X	X	X						
Locker Room Assignment		X				X	X			
Historical Course Sel. Anal		X							X	X

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[3] Some secondary personnel suggested that these could be automatic outputs from Sectioning/Scheduling and they have therefore been included in Phase 1 system design for the Scheduling Sub-system.

	Sub-System Interface[1]	Phase 1			Phase 2			Phase 3		
		SD	P	I	SD	P	I	SD	P	I
5. Mark Reporting Sub-System										
A. Secondary										
Secondary Mark(Grade) Reports	S	X	X	X						
Mark Label for Cum. Records	S	X	X	X						
Failure & Incomplete List	S	X	X	X						
Honor Roll List	S	X	X	X						
Teacher Mark Distributions	S	X	X	X						
Class Rankings	S	X	X	X						
Student/Class Profile	S	X							X	X
Honor Pt. Computation	S	X	X	X						
Departmental Mark Distribution	S	X				X	X			
B. Elementary										
Mark Recording	CE	X	X	X						
Mark Label for Cum. Records	CE	X							X	X
Teacher Mark Distribution	CE	X							X	X

6. Guidance Sub-system	Sub-System Interface [1]	Phase 1 SD	Phase 1 P	Phase 1 I	Phase 2 SD	Phase 2 P	Phase 2 I	Phase 3 SD	Phase 3 P	Phase 3 I
Followup Studies	G-Analysis of post	X	X	X						
Group Counseling Ident.					X	X	X			
Withdrawal Studies & Detection	A	X	X	X						
Analysis of Special Students	M,A				X	X	X			
Over/Under Achievement Analysis & Detection	M,A	X				X	X			
Post High School Educ. Index					X	X	X			
Student Profile - 6th Grade		X				X	X			
Standardized Test Analysis					X	X	X			
Analysis of Post High School Educ/Voc Selections	G-Follow-up studies	X	X	X						
Other Correlations		X				X	X			
Graduation Requirements Analysis	M	X							X	X
Declining Achievement Analysis	M	X							X	X
Financial Aid Index								X	X	X
Transfer Student Analysis								X	X	X
Vocational Interest Analysis								X	X	X
Standardized Test Score Recording [4]		X	X	X						

[4] This potential service refers to the fact of test scores in machine sensible form for recording on an electronic student record. The availability of this data would be necessary for several of the potential services in the Guidance Sub-system.

	Sub-System Interface[1]	Phase 1			Phase 2			Phase 3		
		SD	P	I	SD	P	I	SD	P	I
7. Health Sub-system										
Perm. Health Records					X				X	X
Immun. & Test Processing					X				X	X
Ear, Eye & Dental Exams					X				X	X
State Reports					X				X	X

EXHIBIT A-2

TABLE OF MATERIALS INFORMATION

SUB-SYSTEM APPLICATION PRIORITIES

	Sub-System Interface	Phase 1			Phase 2			Phase 3		
		SD	P	I	SD	P	I	SD	P	I
1. Library										
Book Processing		X	X	X						
Union Catalogue					X	X	X			
Reading Pattern Inventory	SIS				X	X	X			
Circulation Control					X	X	X			
2. Audio-Visual										
Materials Catalogue		X	X	X						
Equipment Property Records	AFIS				X	X	X			
Equipment Maintenance Records	AFIS				X	X	X			
Catalogue of Resource Personnel										
Catalogue of Field Trips								X	X	X

BENEFIT RATING - GUIDANCE/RESEARCH

Potential Service	All Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
Follow-up Studies	348	1	90	1	102	2	103	4	41	5	12	1
Scoring and Analysis of Standardized Tests	344	2	81	2	82	4	120	2	59	1	2	14
Group Counseling Indentification	308	3	46	11	73	9	135	1	54	2	0	16.5
Withdrawal Studies and Detection	278	4	64	3	105	1	82	10	21	15	6	9
Analysis of Special Students	270	5	63	4	87	3	72	13	40	8	8	6
Over/Under Achievement Analysis & Detection	262	6	56	6	67	12	90	7	40	8	9	4
Post High School Education Index	261	7	59	5	68	11	113	3	19	16	2	14
Student Profile - 6th Grade	257	8	53	7	71	10	86	8	41	5	6	9
Standardized Test Analysis	251	9	49	10	80	6	70	14	46	3	6	9
Analysis of Post High School Education/Vocational Selctions	241	10	43	12	63	13	94	6	32	11	9	4
Other Correlations	240	11	52	8	81	5	68	15	29	12	10	2
Graduation Requirement Analysis	239	12	51	9	74	8	85	9	25	14	4	12
Declining Achievement Analysis	237	13	31	17	75	7	81	11	41	5	9	4
Financial Aid Index	216	14	42	13	44	16	102	5	26	13	2	4
Transfer Student Analysis	206	15	36	14.5	57	14	67	16	40	8	6	9
Vocational Interest Analysis	201	16	36	14.5	51	15	75	12	33	10	6	9
Other Services	111	17	38	16	10	17	50	17	13	17	0	16.5

BENEFIT RATING - ELEMENTARY STUDENT PERSONNEL SERVICES

Potential Service	All Groups Gross Points	All Groups Ranking	Group 1 Gross Points	Group 1 Ranking	Group 2 Gross Points	Group 2 Ranking	Group 3 Gross Points	Group 3 Ranking	Group 4 Gross Points	Group 4 Ranking	Group 5 Gross Points	Group 5 Ranking
Annual Attendance Report	415	1	122	1	102	2	165	1	16	15	10	4
Periodic Attendance Accumulation	323.5	2	100	2	74.5	4	120	3	21	10	8	5
Machine Scoring of Stand. Tests	308	3	65	4	118	1	99	7	26	8	0	18
Class Lists	247	4.5	64	5	40	12	111	4	29	4.5	3	11
Scheduling of Tchr Parent Conferences	247	4.5	59	6	60	7	103	5.5	22	9	3	11
Kdgrtn Roundup Mailing	244	6	49	8	49	11	123	2	5	17.5	18	2
Family/Stu. Dir. Locater File	230	7	48	9	59	8	88	9	31	2	4	8
Bus Routing	225	8	56	7	51	10	103	5.5	0	20	15	3
Boundry Line Determination	204	9	80	3	63	5	36	18	5	17.5	20	1
Stud/Family Infor. & Background	187	10	41	12	26	18	89	8	28	6	3	11
Reading Pattern Inventory	178	12	29	15	36	13	79	10	30	3	4	8
Student/Class Profile	178	12	46	10	20	20	67	12.5	44	1	1	14
Mark (Grade) Reports	178	12	35	13	62	6	54	15	27	7	0	18
Mark Label for Cumulative Rec.	173	14	43	11	52	9	47	16	29	4.5	2	13
Envelope Addressing (Labels)	152	15	28	16	32	15.5	73	11	14	16	5	6
Tchr Mark Distributions	142	16	24	18.5	32	15.5	67	12.5	19	12	0	18
Parent Teacher Opinion Surveys	121	17.5	31	14	27	17	42	17	17	13.5	4	8
Mach Scoring of Tchr Prep. Tests	121	17.5	12	21	33	14	56	14	20	11	0	18
Other Services	102	19	24	18.5	78	3	0	21	0	20	0	18
Beh. Trait Posting	99	20	25	17	24	19	33	19	17	13.5	0	18
Bus Passes	34.5	21	15	20	1.5	21	18	20	0	20	0	18

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BENEFIT RATING - SECONDARY STUDENT PERSONNEL (JUNIOR HIGHS (7-9)

Potential Service	All Groups Gross Points	All Groups Ranking	Group 1 Gross Points	Group 1 Ranking	Group 2 Gross Points	Group 2 Ranking	Group 3 Gross Points	Group 3 Ranking	Group 5 Gross Points	Group 5 Ranking
Student Secioning Schedules	415	1	211	1	153	1	16	3	35	1
Mark (Grade) Reports	362	2	190	2	123	2	16	3	33	2
Annual Attendance Reports	299	3	150	3	102	3	16	3	31	3
Class Lists	252	4	130	4	80	4	12	7	30	4
Mark Label for Cumulative Records	200	5	117	5	64	8	8	12	11	10
Teacher Mark Distribution	191	6	100	6	66	6.5	6	16.5	19	7
Failure and Incomplete List	182	7	84	9	66	6.5	10	9	22	5
Honor Roll List	172	8	63	15.5	74	5	14	6	21	6
Periodic Attendance Accumulation	163	9	83	10	62	9	10	9	8	14
Course Tally	160	10	77	11.5	55	11.5	16	3	12	9
Student-Class Profile	155	11	91	8	53	14	6	16.5	5	19
Daily Absentee Lists	153	12	96	7	49	15	8	12	0	23.5
Behavior Trait Posting	140	13	68	14	56	10	6	16.5	10	11
Student Directory	132	14	77	11.5	37	20	4	20	14	8
Departmental Mark Distribution	131	15	63	15.5	55	11.5	6	16.5	7	16.5
Envelope Addressing	127	16	72	13	46	16.5	4	20	5	19
Conflict Matrix	122	17	62	17	36	21.5	16	3	8	14
Student Activity Posting	113	18	54	19	46	16.5	6	16.5	7	16.5
Locker Room Assignments	112	19.5	58	18	45	18	0	24.5	9	12
Reading Pattern Inventory	112	19.5	50	20	54	13	8	12	0	23.5
Honor Point Computation	98	21	37	22	43	19	10	9	8	14
Class Rankings	80	22	40	21	36	21.5	4	20	0	23.5
Student I.D. Cards	74	23	36	23	33	23	0	24.5	5	19
Teacher/Parent Opinion Survey	60	24	33	24	25	25	2	22	0	23.5
Historical Course Selection Analysis	58	25	30	25	28	24	0	24.5	0	23.5
Other Services	29	26	25	26	4	26	0	24.5	0	23.5

BENEFIT RATING - SECONDARY STUDENT PERSONNEL (SENIOR HIGHS 10-12, 7-12, and 9-12)

	All Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
Potential Service	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
Student Sectioning Schedules	351	1	102	1	111	1	107	1	22	6	9	6
Mark (Grade) Reports	309	2	93	2	81	2	101	2	24	3	10	1
Conflict Matrix	283	3	92	3	69	3	100	3	14	13	8	13.5
Class Lists	254	4	70	6	63	4	85	4	29	1.5	7	13.5
Class Rankings	249	5	81	4	61	5	70	10.5	29	1.5	8	13.5
Course Tally	235	6	79	5	59	6	75	7	13	17	9	6
Annual Attendance Reports	220	7	61	7.5	57	7	76	6	17	9	9	6
Failure & Incomplete List	205	8	61	7.5	50	10	71	9	14	13	9	6
Honor Roll List	204	9	51	10	55	8	80	5	9	22.5	9	6
Mark Label for Cumulative Records	203	10	54	9	47	12	70	10.5	23	4	9	6
Honor Point Computation	198	11	47	11	50	10	73	8	19	9	9	6
Teacher Mark Distribution	170	12	42	13	43	14	65	12	12	19	8	13.5
Student Directory	166	13	44	12	35	17	56	14.5	22	6	9	6
Student/Class Profile	158	14	40	14	35	17	54	16	22	6	7	13.5
Behavior Trait Posting	151	15	39	15	38	15	56	14.5	10	20	8	13.5
Daily Absentee Lists	149	16	32	16.5	50	10	44	21.5	14	13	9	6
Periodic Attendance Accumulation	143	17	29	18.5	44	13	48	19.5	14	13	8	13.5
Departmental Mark Distribution	142	18	32	16.5	33	19.5	57	13	13	17	7	18.5
Student Activity Posting	125	19	22	21	35	17	51	17.5	9	22.5	8	13.5
Envelope Addressing	123	20	21	22	31	21.5	51	17.5	13	17	7	18.5
Student I.D. Cards	119	21	29	18.5	31	21.5	44	21.5	9	22.5	6	23
Locker Room Assignments	113	22	23	20	27	25	48	19.5	9	22.5	6	23
Reading Pattern Inventory	112	23	19	24	29	24	42	23	16	10	6	23
Historical Course Selection Analysis	100	24	20	23	30	23	38	24	6	25	6	23
Tea./Par. Opin. Surv.	99	25	12	25	33	19.5	34	25	14	13	6	23
		26	0	26	0	26	7	26	0	26	3	26

BENEFIT RATING--SECONDARY STUDENT PERSONNEL (TOTAL SECONDARY--Jr. and Sr. Highs)

	All Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
Potential Service	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
Student Sectioning/ Schedules	766	1	313	1	264	1	123	1	22	6	44	1
Mark (Grade) Reports	671	2	283	2	204	2	117	2	24	3	43	2
Annual Atten. Reports	519	3	211	3	159	3	92	7	17	9	40	3
Class Lists	506	4	200	4	143	4	97	5	29	1.5	37	4
Conflict Matrix	405	5	154	7	105	12	116	3.5	14	13	16	13.5
Mark Label for Cumulative Records	403	6	171	5	111	9	78	10	23	4	20	10
Course Tally	395	7	156	6	114	8	91	8	13	17	21	9
Failure and Incomplete List	387	8	145	8	116	7	81	9	14	13	31	5
Honor Roll List	376	9	114	14	129	5	94	6	9	22.5	30	6
Teacher Mark Dist.	361	10	142	9	109	10	71	12	12	19	27	7
Class Rankings	329	11	121	12.5	127	6	74	11	29	1.5	8	22
Stu./Class Profile	313	12	131	10	88	16.5	60	15	22	6	12	18.5
Periodic Attendance Accumulation	306	13	112	15	106	11	58	17	14	13	16	13.5
Daily Absentee Lists	302	14	128	11	99	13	52	20	14	13	9	21
Student Directory	298	15	121	12.5	72	21.5	60	16	22	6	23	8
Honor Point Comput.	296	16	84	19	93	15	116	3.5	19	8	17	12
Student I.D. Cards	293	17	65	23	64	23	44	23	9	22.5	11	20
Behavior Trait Posting	291	18	107	16	94	14	62	14	10	20	18	11
Departmental Mark Distribution	273	19	95	17	88	16.5	63	13	13	17	14	17
Envelope Addressing	250	20	93	18	77	20	55	19	13	17	12	18.5
Student Act. Posting	238	21	76	21	81	19	57	18	9	22.5	15	15.5
Locker Room Assign.	225	22	81	20	72	21.5	48	22	9	22.5	15	15 5
Reading Pattern Inventory	224	23	69	22	83	18	50	21	16	10	6	24
Teacher/Parent Opinion Surveys	159	24	45	25	58	24.5	36	25	14	13	6	24
Historical Course Selection Analysis	158	25	50	24	58	24.5	38	24	6	25	6	24
Other Services	48	26	34	26	4	26	7	26	0	26	3	26

BENEFIT RATING--SECONDARY STUDENT PERSONNEL

RELATIONSHIP OF SECONDARY STUDENT PERSONNEL SERVICE TO TEST SCORING OF TEACHER PREPARED TESTS SERVICE FOR:

Potential Service	All Groups Gross Points	All Groups Ranking	Group 1 Gross Points	Group 1 Ranking	Group 2 Gross Points	Group 2 Ranking	Group 3 Gross Points	Group 3 Ranking	Group 4 Gross Points	Group 4 Ranking	Group 5 Gross Points	Group 5 Ranking
A. Junior Highs 7-9												
Secondary Student Personnel	3192	1	1687	1	1060	1	160	1	*	*	285	1
Test Scoring of Teacher Prepared Tests	808	2	413	2	340	2	40	2	*	*	15	2
B. Senior Highs 10-12, 7-12, and 9-12.												
Secondary Student Personnel	3685	1	990	1	870	1	1315	1	310	1	200	1
Test Scoring of Teacher Prepared Tests	960	2	195	2	330	2	285	2	150	2	0	2
C. Jr. and Sr. Highs--Total Secondary												
Secondary Student Personnel	6877	1	2677	1	1930	1	1475	1	310	1	485	1
Test Scoring of Teacher Prepared Tests	1768	2	608	2	670	2	325	2	150	2	15	2

*No Junior Highs Reported for Group 4.

BENEFIT RATING LIBRARY - ELEMENTARY

POTENTIAL SERVICE	ALL GROUPS		GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
BOOK PROCESSING	1148	1	305	1	348	1	415	1	80	1		
UNION CATALOGUE	725	2	200	2	230	2	255	4	40	5		
READING PATTERN INVENTORY	651	3	190	3	96	6	295	3	70	2		
STUDENT/CLASS PROFILE	589	4	140	4	84	5	315	2	50	4		
CIRCULATION CONTROL	477	5	65	5	112	4	240	5	60	3		
OTHER	210	6	0	6	130	3	80	6	0	6		

BENEFIT RATING LIBRARY - SECONDARY

POTENTIAL SERVICE	ALL GROUPS		GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
BOOK PROCESSING	985	1	225	1	310	1	355	1	75	1	20	2
UNION CATALOGUE	830	2	190	2	235	2	335	2	40	3	30	1
CIRCULATION CONTROL	690	3	160	3	220	3	255	4	45	2	10	3
STUDENT/CLASS PROFILE	610	4	145	4	110	6	315	3	10	6	30	1
READING PATTERN INVENTORY	580	5	125	5	185	4	245	5	15	4	10	3
OTHER	340	6	90	6	140	5	95	6	15	5	0	6

BENEFIT RATING LIBRARY - COMBINED ELEMENTARY & SECONDARY**

POTENTIAL SERVICE	ALL GROUPS		GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
BOOK PROCESSING	2133	1	530	1	658	1	770	1	155	1	20	2
UNION CATALOGUE	1555	2	390	2	465	2	590	3	80	4	30	1
READING PATTERN INVENTORY	1231	3	315	3	281	4	540	4	85	3	10	3
STUDENT/CLASS PROFILE	1199	4	285	4	194	6	630	2	60	5	30	1
CIRCULATION CONTROL	1167	5	225	5	332	3	495	5	105	2	10	3
OTHER	550	6	90	6	270	5	175	6	15	6	0	1

**It is necessary to note that the combined benefit rating reflects the emphasis of the elementary school particularly in the Reading Pattern Inventory.

BENEFIT RATING SHEET - AUDIO-VISUAL

	Total Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
	Gross Points	Rank	Gross Points	Rank	Gross Points	Rank	Gross Points	Rank	Gross Points	Rank	Gross Points	Rank
aterials Catalogue	1780	1	470	1	500	1	610	1	170	1	30	1
quipment Property Records	775	2	180	2	250	2	248	2	82	3	15	3
quipment Maintenance Records	605	3	135	3	190	3	202	5	63	4	15	3
Catalogue of Resource Personnel	481	4	56	5	90	5	235	4	90	2	10	4
Catalogue of Field Trips	439	5	54	6	75	6	245	3	55	5	10	4
Other	285	6	105	4	120	4	60	6	0	6	20	2

Benefit Rating - Health Service

Potential Service	Gross Points Total Groups	Ranking Total Total Groups	Gross Points Group 1	Ranking Group 1	Gross Points Group 2	Gross Points Group 2	Ranking Group 3	Ranking Group 3	Gross Points Group 4	Ranking Group 4	Gross Points Group 5	Ranking Group 5
Permanent Health Records	1095	1	255	1	280	2	450	1	85	2	25	1.5
Immunization and Test Processing	1010	2	235	2	270	3	375	2.5	105	1	25	1.5
Ear, Eye, and Dental Exam.	915	3	150	4	310	1	375	2.5	65	3	15	3.5
State Reports	805	4	210	3	255	4	280	4	45	4	15	3.5
Other Services	265	5	140	5	85	5	20	5	0	5	20	5

Benefit Rating Transportation

	All Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
	Rank	Gross Points	Rk	Gross Points	Rk	Gross Points	Rk	Gross Points	Rk	Gross Points	Rk	Gross Points
Bus Routing	1	1505	1	425	1	500	2	455	1	100	1	25
Transportation Report	2	1450	2	370	2	285	1	570	5	0	5	0
Bus Maintenance	3	445	4	95	3	205	4.5	110	5	0	1	25
Bus Passes	4	365	3	110	4	100	3	155	5	0	1	25
Other	5	145	5	0	5	10	4.5	110	5	0	1	25

BENEFIT RATING - BUSINESS OFFICE

Potential Service	All Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
Accounts Payable	574	2	129	2	167	2	211	12	60	2.5	7	7
Appropriation and Budgetary Control	456	3	122	3	131	3	151	3	35	5	17	1.5
Payroll	763	1	202	1	231	1	248	1	65	1	17	1.5
Property Records	241	8	65	6	76	5	83	8	10	10.5	7	7
Activity Fund Accounting	284	5	46	11	60	8.5	116	4	60	2.5	2	13
Preventative Maintenance scheduling	181.5	11	50	10	46.5	12	57	12	25	8	3	11.5
Maintenance Cost Accounting	297	4	80	4	60	8.5	99	6	50	4	8	5
Inventory Control	266	7	78	5	67	7	101	5	10	10.5	10	3.5
Purchasing	268	6	54	9	91	4	91	7	25	8	7	7
Test Book Inventory	229	9.5	56	8	70	6	75	9	25	8	3	11.5
Food Service-Perpetual Inventory	159.5	12	34	12	55	10	61.5	11	5	12	4	10
Food Service Cost Accounting	229	9.5	64	7	50.5	11	74.5	10	30	6	10	3.5
Other	47	13	20	13	0	13	22	13	0	13	5	9

BENEFIT RATING--SUPERINTENDENTS' QUESTIONNAIRE

Potential Service	Total Groups		Group 1		Group 2		Group 3		Group 4		Group 5	
	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking	Gross Points	Ranking
Business Office	749	1	188	1	216	1	245	1	75	1	25	1
Secondary Students Personnel	525	2	144	2	127	3	224	2	15	7.5	15	2
Instructional Uses	449	3	98	4	173	2	158	3	15	7.5	5	7.5
Guidance and Research	390	4	108	3	85	5	132	7	60	2	5	7.5
Personnel Records	376	5	97	5	97	4	149	5	28	4	5	7.5
Elementary Student Personnel	339	6	78	6	79	6	145	6	25	5	12	3
Test Scoring	329	7	64	8	76	7	151	4	33	3	5	7.5
Census	283	8	69	7	65	8	129	8	10	9.5	10	4.5
Library	230	9	43	10	59	9	109	9	16	6	3	10.5
Transportation	218	10	48	9	48	10	102	10	10	9.5	10	4.5
Health Service	161	11	30	12	30	12	91	11	8	11	2	12
Audio Visual	143	12	33	11	39	11	63	12	5	12	3	10.5
Other	8	13	0	13	6	13	2	13	0	13	0	13

FORECAST OF AVAILABILITY RATE OF

DATA PROCESSING SERVICES

STUDENT AND ADMINISTRATIVE/FINANCIAL SYSTEMS

(Thousands Omitted)

Service	Fiscal Year	Basis	Number Added	Cumulative Number
Student Information System				
Secondary Attendance/ Mark Reporting/ Scheduling/Guidance	1969	Sec. Pupils	25	
	1970		30	55
	1971		40	95
	1972		20	115
Census/Elem. Attend/ Mark Recording	1969	Elem. Pupils	30	
	1970		40	70
	1971		30	100
	1972		30	130
Admin./Financial Info. Sys				
Empl. Info	1969	Employee	3	
	1970		4	7
	1971		4	11
	1972		3	14
Accounts Payable/Approp & Budgetary Acctg.	1970	Pupils K-12	30	
	1971		50	80
	1972		60	140

BASIS OF MEMBERSHIP DUES FOR NO

	Public Price	Public Basis K-12	Total Costs Public K-12	No
A. Data Processing Service				
1. Secondary Student Info	$3.50/Sec Pupil	7M	$24,500	$2
2. Census Elem.	$1.50/Elem Pupil	12M	18,000	
3. Guidance	$1/Sec. Pupil	7M	7,000	1
4. Empl. Info.	$12/Emp.	1,200	14,400	12
5. AP/ABA	.75/pupil	19,000	14,250	
6. Test Scoring	.20/test	4 tests/Sec pupil	5,600	
			$83,750	
B. Per Pupil Costs			4.41	
C. Per Pupil Cost as a percentage of public K-12 per pupil cost			100%	

UES FOR NON-PUBLIC SCHOOLS

Total Costs Public K-12	Non-Public Price	Non-Public Basis 9-12	Total Costs Non-Public 9-12	Non-Public Basis 1-8	Total Costs Non-Public 9-12
$24,500	$2.50	3,600	$ 9,000	3,600	$ 9,000
18,000	.75	-	-	11,780	8,835
7,000	1.00	3,600	3,600	3,600	3,600
14,400	12.00	-	-		
14,250	.75	-	-		
5,600	.20	4 tests/Sec pupil	2,800	4 tests/Sec pupil	2,800
$83,750			$15,400		$24,235
4.41			4.28		1.58
100%			97%		36%

GLOSSARY

access, random, (1) pertaining to the process of obtaining information from or placing information into storage where the time required for such access is independent of the location of the information most recently obtained or placed in storage; (2) pertaining to a device in which random access, as defined in definition 1, can be achieved without effective penalty in time.

alphanumeric, a contraction of alphabetic-numeric.

analysis, systems, the examination of an activity, procedure, method, technique, or a business to determine what must be accomplished and how the necessary operations may best be accomplished.

analyst, a person skilled in the definition of and the development of techniques for the solving of a problem; especially those techniques for solutions on a computer.

application, the system or problem to which a computer is applied. Reference is often made to an application as being either of the computational type, wherein arithmetic computations predominate, or of the data processing type, wherein data handling operations predominate.

assembler, a computer program which operates on symbolic input data to produce from such data machine instructions by carrying out such functions as: translation of symbolic operation codes into computer operating instructions; assigning locations in storage for successive instructions; or computation of absolute addresses from symbolic addresses. An assembler generally translates input symbolic codes into machine instructions item for item, and produces as output the same number of instructions or constants which were defined in the input symbolic codes. Synonymous with (assembly routine); (assembly program) and related to (compiler).

batch processing, see (processing, batch)

baud, (1) a unit of signalling speed equal to the number of code elements per second; (2) the unit of signalling speed equal to twice the number of Morse code dots continuously sent per second. Clarified by (rate, bit) and (capacity, channel).

benefit rating, establishing a numerical value representing the relative benefit of two or more compared data processing services.

card, punch, a heavy stiff paper of constant size and shape, suitable for punching in a pattern that has meaning, and for being handled mechanically. The punched holes are sensed electrically by wire brushes, mechanically by metal fingers, or photoelectrically by photocells. Related to (card, eighty column) and (card, ninety column).

card punch unit, same as (punch, card).

center, data processing, a computer installation providing data processing service for others, sometimes called customers, on a reimbursable or non-reimbursable basis.

central processing unit, same as (frame, main) (1).

character, (1) one symbol of a set of elementary symbols such as those corresponding to the keys on a typewriter. The symbols usually include the decimal digits 0 through 9, the letters A through Z, punctuation marks, operation symbols, and any other single symbols which a computer may read, store, or write. (2) The electrical, magnetic, or mechanical profile used to represent a character in a computer, and its various storage and peripheral devices. A character may be represented by a group of other elementary marks, such as bits or pulses.

chart, flow, a graphic representation of the major steps of work in process. The illustrative symbols may represent documents, machines, or actions taken during the process. The area of concentration is on where or who does what rather than how it is to be done. Synonymous with (process chart) and (flow diagram).

COBOL, Common Business Oriented Language, see (language, common business oriented).

coding, the ordered list in computer code or pseudo code, of the successive computer instructions representing successive computer operations for solving a specific problem.

collate, to merge two or more ordered sets of data, or cards in order to produce one or more ordered sets which still reflect the original ordering relations. The collation process is the merging of two sequences of cards, each ordered on some mutual key, into a single sequence ordered on the mutual key.

collator, a device used to collate or merge sets or decks of cards or other units into a sequence. A typical example of a card collator has two input feeds, so that two ordered sets may enter into the process, and four output stackers, so that four ordered sets can be generated by the process. Three comparison stations are used to route the cards to one stacker or the other on the basis of comparison of criteria as specified by plugboard wiring.

compatibility, equipment, the characteristics of computers by which one computer may accept and process data prepared by another computer without conversion or code modification.

compiler, a computer program more powerful than an assembler. In addition to its translating function which is generally the same process as that used in an assembler it is able to replace certain items of input with series of instructions, usually called subroutines. Thus, where an assembler translates item for item, and produces as output the same number of instructions or constants which were put into it, a compiler will do more than this. The program which results from compiling is a translated and expanded version of the original. Synonymous with (compiling routine) and related to (assembler).

computer, a device capable of accepting information, applying prescribed processes to the information, and supplying prescribed processes to the information, and supplying results of these processes. It usually consists of input and output devices, storage, arithmetic, and logical units, and a control unit.

configuration, a group of machines which are interconnected and are programed to operate as a system.

CPU, Central Processing Unit, same as (frame, main (1)).

CRI, see instruction computer related.

data center, commercial, a commercial firm engaged in the business of supplying data processing services for compensation.

data phone, see (phone, data).

data processing center, see (center, data processing).

diagram, block, (1) a graphical representation of the hardware in a computer system. The primary purpose of a block diagram is to indicate the paths along which information and/or control flows between the various parts of a computer system. It should not be confused with the term flow chart. (2) A coarser and less symbolic representation than a flow chart.

digit, a sign or symbol used to convey a specific quantity of information either by itself or with other numbers of its set; e.g., 2, 3, 4, and 5 are digits. The base or radix must be specified and each digit's value assigned.

direct access, see random access.

disk, magnetic, a storage device on which information is recorded on the magnetizable surface of a rotating disk. A magnetic disk storage system is an array of such devices, with associated reading and writing heads which are mounted on movable arms. Related to (storage, disk).

document, (1) a form, voucher, or written evidence of a transaction; (2) to instruct, as by citation of references; (3) to substantiate, as by listing of authorities.

documentation, the group of techniques necessary for the orderly presentation, organization and communication of recorded specialized knowledge, in order to maintain a complete record of reasons for changes in variables. Documentation is necessary not so much to give maximum utility as to give an unquestionable historical reference record.

drive, tape, same as (transport, tape). Synonymous with (unit, tape), and clarified by (unit, magnetic tape) and (unit, paper tape).

EDP, Electronic Data Processing, see (processing, electronic data).

electronic data processing, see (processing, electronic data).

equipment, auxiliary, same as (equipment, off-line (1)).

equipment, off-line, the peripheral equipment or devices not in direct communication with the central processing unit of a computer. Synonymous with (auxiliary equipment).

equipment, on-line, descriptive of a system and of the peripheral equipment or devices in a system in which the operation of such equipment is under control of the central processing unit, and in which information reflecting current activity is introduced into the data processing system as soon as it occurs. Thus, directly in-line with the main flow of transaction processing. Synonymous with (in-line processing), and (on-line processing).

file, an organized collection of information directed toward some purpose. The records in a file may or may not be sequenced according to a key contained in each record.

file, master, a file containing relatively permanent information.

flow chart, see (chart, flow)

frame, main, (1) the central processor of the computer system. It contains the main storage, arithmetic unit and special register groups. Synonymous with (CPU) and (central processing unit). (2) All that portion of a computer exclusive of the input, output, peripheral and in some instances, storage units.

hardware, the physical equipment or devices forming a computer and peripheral equipment. Contrasted with (software).

high-speed printer, see (printer, high-speed).

high-speed reader, see (reader, high-speed).

implementation, placing of an application in operational status.

information retrieval system, see (system, information retrieval).

information system, see (system, information).

input, (1) information or data transfered or to be transfered from an external storage medium into the internal storage of the computer, (2) describing the routines which direct input as defined in (1) or the devices from which such information is available to the computer. (3) the device or collective set of devices necessary for input as defined in (1).

inquiry, a technique whereby the interrogation of the contents of a computer's storage may be initiated at a keyboard.

inquiry station, see (station, inquiry).

instruction, advanced computer related, use of computers as part of the instructional process and employing terminals with multiple input output media for direct student contact or use of two way terminals in sophisticated learning situations.

instruction, computer related, use of computers as part of the instructional process, but not necessarily involving direct student contact with hardware.

keypunch, (1) a special device to record information in cards or tape by punching holes in the cards or tape to represent letters, digits, and special characters; (2) to operate a device for punching holes in cards or tape.

key-verify, to use the punched card machine known as a verifier, which has a keyboard, to make sure that the information supposed to be punched in a punch card has actually been properly punched. The machine signals when the punched hole and the depressed key disagree.

language, common business oriented, a specific language by which business data processing procedures may be precisely described in a standard form. The language is intended not only as a means for directly presenting any business program to any suitable computer, for which a compiler exists, but also as a means of communicating such procedures among individuals. Synonymous with (COBOL).

language, program, a language which is used by programmers to write computer routines.

library, (1) a collection of information available to a computer, usually on magnetic tapes; (2) a file of magnetic tapes.

lines, communication, lines provided by common carriers (telephone, telegraph companies) for transmission of conversation or data.

LPM, Lines Per Minute.

machine operator, see (operator, machine).

magnetic disk, see (disk, magnetic).

magnetic disk storage, see (storage, magnetic disk).

magnetic drum, see (drum, magnetic).

magnetic drum storage, see (storage, magnetic drum).

magnetic tape, see (tape, magnetic).

magnetic tape storage, see (storage, magnetic tape).

main frame, see (storage, main).

maintenance, file, the periodic modification of a file to incorporate changes which occurred during a given period.

mark sensing, see (sensing, mark).

master file, see (file, master).

multiprocessor, a machine with multiple arithmetic and logic units for simultaneous use.

multiprograming, a technique for handling numerous routines or programs simultaneously by means of an interweaving process.

off-line, descriptive of a system and of the peripheral equipment or devices in a system in which the operation of peripheral equipment is not under the control of the central processing unit. Clarified by (equipment, off-line).

on-line, descriptive of a system and of the peripheral equipment or devices in a system in which the operation of such equipment is under control of the central processing unit, and in which information reflecting current activity is introduced into the data processing system as soon as it occurs. Thus, directly in-line with the main flow of transaction processing. Clarified by (equipment, on-line); synonymous with (in-line processing), and (on-line processing).

on-premise, on the premise of the personnel causing the hardware to function.

operation, real time, the use of the computer as an element of a processing system in which the times of occurrence of data transmission are controlled by other portions of the system, and cannot be modified for convenience in computer programming. Such an operation either proceeds at the same speed as the events being simulated or at a sufficient speed to analyze or control external events happening concurrently.

operator, machine, the person who manipulates the computer controls, places information media into the input devices, removes the output and performs other related functions.

output, (1) the information transferred from the internal storage of a computer to secondary or external storage, or to any device outside of the computer; (2) the routines which direct 1; (3) the device or collective set of devices necessary for 1; (4) to transfer from internal storage on to external media.

phone, data, a generic term to describe a family of devices available to facilitate data communication.

price/thruput, relationship of price of the entire system and the amount of data it can process under various conditions.

printer, high-speed, a printer which operates at a speed more compatible with the speed of computation and data processing so that it may operate on-line. At the present time a printer operating at a speed of 250 lines per minute, 100 characters per line is considered high-speed. Synonymous with HSP.

printer, line, a device capable of printing one line of characters across a page; i.e., 100 or more characters simultaneously as continuous paper advances line by line in one direction past type bars or a type cylinder that contains all characters in all positions.

processing, batch, a technique by which items to be processed must be coded and collected into groups prior to processing.

processing, data, (1) the preparation of source media which contain data or basic elements of information, and the handling of such data according to precise rules of procedure to accomplish such operations as classifying, sorting, calculating, summarizing, and recording. (2) The production of records and reports. Synonymous with (data handling).

processing, electronic data, data processing performed largely by electronic equipment. Synonymous with (EDP) and related to (processing, automatic data).

processing, information, a less restrictive term than data processing, encompassing the totality of scientific and business operations performed by a computer.

processing, integrated data, (1) a system that treats as a whole, all data processing requirements to accomplish a sequence of data processing steps, or a number or related data processing sequences, and which strives to reduce or eliminate duplicating data entry or processing steps. (2) The processing of data by such a system. Synonymous with (IDP).

processing, on-line, same as (on-line (2)).

processing, real time, the processing of information or data in a sufficiently rapid manner so that the results of the processing are available in time to influence the process being monitored or controlled. Synonymous with (real time system).

program, (1) the complete plan for the solution of a problem, more specifically the complete sequence of machine instructions and routines necessary to solve a problem. (2) To plan the procedures for solving a problem. This may involve among other things the analysis of the problem, preparation of a flow diagram, preparing details, testing, and developing subroutines, allocation of storage locations, specification of input and output formats, and the incorporation of a computer run into a complete data processing system. Related to (routine).

program, control, a sequence of instructions which prescribe the series of steps to be taken by a system, a computer or any other device.

program language, see (language, program).

program test, see (test, program).

program, utility, same as (routine, utility).

programer, a person who prepares problem solving procedures and flow charts and who may also write and debug routines.

punch, card, a machine which punches cards in designated locations to store data which can be conveyed to other machines or devices by reading or sensing the holes. Synonymous with (card punch unit).

random access, see (access, random).

random access memory, same as (storage, random access).

random access storage, see (storage, random access).

read, (1) to sense information contained in some source, (2) the sensing of information contained in some source.

read while writing, the reading of a record or group of records into storage from tape at the same time another record or group of records is written from storage to tape.

reader, high-speed, a reading device capable of being connected to a computer so as to operate on-line without seriously holding up the computer. A card reader reading more than 250 cards per minute would be called a high-speed reader. A reader which reads punched paper tape at a rate greater than 50 characters per second could also be called a high-speed reader. Synonymous with (HSR).

reader, magnetic tape, a device capable of sensing information recorded on a magnetic tape in the form of a series of magnetized spots.

real time processing, see (processing, real time).

record, (1) a group of related facts or fields of information treated as a unit, thus a listing of information, usually in printed or printable form; (2) to put data into a storage device.

record, unit, (1) a separate record that is similar in form and content to other records; e.g., a summary of a particular employee's earnings to date. (2) Sometimes refers to a piece of non-tape auxiliary equipment, e.g., card reader, printer or console typewriter.

reproducer, card, a device that reproduces a punch card by punching another similar card.

rerun, to repeat all or part of a program on a computer.

retrieval, information, the recovering of desired information or data from a collection of documents or other graphic records.

routine, utility, a standard routine used to assist in the operation of the computer; e.g., a conversion routine, a sorting routine, a print-out routine, or a tracing routine. Synonymous with (utility program).

run, the performance of one program on a computer, thus the performance of one routine, or several routines linked so that they form an automatic operating unit, during which manual manipulations by the computer operator are zero, or at least minimal.

run, machine, the execution of one or several machine routines which are linked to form one operating unit.

serial, (1) the handling of one after the other in a single facility, such as transfer or store in a digit-by-digit time sequence, or to process a sequence of instructions one at a time; i.e., sequentially. (2) The time sequence transmission of, storage of, or logical operations on the parts of a word, with the same facilities for successive parts. Related to (operation, serial), and contrasted with (parallel (2)).

software, the totality of programs and routines used to extend the capabilities of computers, such as compilers, assemblers, narrators, routines, and subroutines. Contrasted with (hardware).

sort, to arrange items of information according to rules dependent upon a key or field contained in the items or records; e.g., to digital sort is to sort first the keys on the least significant digit, and to resort on each higher order digit until the items are sorted on the most significant digit.

sort, merge, to produce a single sequence of items, ordered according to some rule, from two or more previously unordered sequences, without changing the items in size, structure, or total number, although more than one pass may be required for a complete sort, items are selected during each pass on the basis of the entire key.

sorter, a machine which puts items of information into a particular order; e.g., it will determine whether A is greater than, equal to or less than B and sort or order accordingly. Synonymous with (sequencer).

source document, see (document, souce).

station, inquiry, the remote terminal device from which an inquiry into computing or data processing equipment is made.

storage, (1) the term preferred to memory. (2) Pertaining to a device in which data can be stored and from which it can be obtained at a later time. The means of storing data at a later time. The means of storing data may be chemical, electrical or mechanical. (3) A device consisting of electronic, electrostatic, electrical, hardware or other elements into which data may be entered, and from which data may be obtained as desired. (4) The erasable storage in any given computer. Synonymous with (memory).

storage, auxiliary, a storage device in addition to the main storage of a computer; e.g., magnetic tape, disk or magnetic drum. Auxiliary storage usually holds much larger amounts of information than the main storage, and the information is accessible less rapidly. Contrasted with (storage, main).

storage, core, same as (storage, magnetic core).

storage, disk, the storage of data on the surface of magnetic disks. Related to (disk, magnetic) and (storage, magnetic disk).

storage, magnetic core, a storage device in which binary data is represented by the direction of magnetization in each unit of an array of magnetic material, usually in the shape of toroidal rings, but also in other forms such as wraps on bobbins. Synonymous with (core storage).

storage, magnetic disk, a storage device or system consisting of magnetically coated disks, on the surface of which information is stored in the form of magnetic spots arranged in a manner to represent binary data. These data are arranged in circular tracts around the disks and are accessible to reading and writing heads on an arm which can be moved mechanically to the desired disk and then to the desired track on that disk. Data from a given track are read or written sequentially as the disk rotates. Related to (storage, disk).

storage, *magnetic tape*, a storage device in which data is stored in the form of magnetic spots on metal or coated plastic tape. Binary data are stored as small magnetized spots arranged in column form across the width of the tape. A read-write head is usually associated with each row of magnetized spots so that one column can be read or written at a time as the tape traverses the head.

storage, *main*, usually the fastest storage device of a computer and the one from which instructions are executed. Contrasted with (storage, auxiliary).

storage, *random access*, a storage technique in which the time required to obtain information is independent of the location of the information most recently obtained. This strict definition must be qualified by the observation that we usually mean relatively random. Thus, magnetic drums are relatively non-random access when compared to magnetic cores for main storage, but are relatively random access when compared to magnetic tapes for file storage. Synonymous with (random access memory) and contrasted with (storage, sequential access).

system, an assembly of procedures, processes, methods, routines or techniques united by some form of regulated interaction to form an organized whole.

system analysis, synonymous with (analysis, system).

system, *electronic data processing*, the general term used to define a system for data processing by means of machine utilizing electronic circuitry at electronic speed, as opposed to electromechanical equipment.

system, *information*, the network of all communication methods within an organization. Information may be derived from many sources other than a data processing unit, such as by telephone, by contact with other people, or by studying an operation.

system, *operating*, an integrated collection of service routines for supervising the sequencing of programs by a computer. Operating systems may perform debugging, input-output, accounting, compilation, and storage assignment tasks. Synonymous with (monitor system) and (executive system).

system, *real time*, same as (processing, real time).

system, *sub*, a component of a larger information system, and often comprised of two or more applications.

system, *total information*, implies more comprehensive design or execution than information system.

systems design, detailed, creating many representations of a graphic nature i.e. schematics, flow charts, record formats, form designs, templates, and narrative to depict the detailed nature of an application and its component computer runs.

systems design, general, creating the necessary representations graphic and narrative to depict the general nature of an information system, sub-system or application prior to detailed design.

systems analysis, see (analysis, systems).

tape drive, same as (transport, tape).

tape, magnetic, a tape or ribbon of any material impregnated or coated with magnetic or other material on which information may be placed in the form of magnetically polarized spots.

tape, paper, a strip of paper capable of storing or recording information. Storage may be in the form of punched holes, partially punched holes, carbonization or chemical change of impregnated material, or by imprinting. Some paper tapes, such as punched paper tapes, are capable of being read by the input device of a computer or a transmitting device by sensing the pattern of holes which represent coded information.

tape, punch, a tape, usually paper, upon which data may be stored in the form of punched holes. Hole locations are arranged in columns across the width of the tape. There are usually 5 to 8 positions, channels, per column, with data represented by a binary coded decimal system. All holes in a column are sensed simultaneously in a manner similar to that for punch cards. Synonymous with (perforated tape).

terminal, any type of hardware device permitting one or two way communication with a computer via communication lines.

time, access, (1) the time it takes a computer to locate data or an instruction word in its storage section and transfer it to its arithmetic unit where the required computations are performed. (2) The time it takes to transfer information which has been operated on from the arithmetic unit to the location in storage where the information is to be stored. Synonymous with (read time); (real time) and related to (time, write) and (time, word(2)).

time-sharing, the use of a device for two or more purposes during the same overall time interval, accomplished by interspersing component actions in time.

time, turn around, the time required to reverse the direction of transmission in a communication channel.

transport, tape, the mechanism which moves magnetic or paper tape past sensing and recording heads and usually associated with data processing equipment. Synonymous with (tape transport), (tape drive), and (feed, tape); related to (unit, tape);(unit, magnetic tape); and (unit, paper tape).

tube, cathode ray, (1) an electronic vacuum tube containing a screen on which information may be stored by means of a multigrid modulated beam of electrons from the thermionic emitter storage effected by means of charged or uncharged spots, (2) a storage tube, (3) an oscilloscope tube, (4) a picture tube.

unit, card punch, same as (punch, card).

unit record, see (record, unit).

unit, tape, a device consisting of a tape transport, controls, a set of reels and a length of tape which is capable of recording and reading information on and from the tape, at the request of the computer under the influence of a program. Clarified by (transport, tape); (unit, magnetic tape); and (unit, paper tape).

update, (1) to put into a master file changes required by current information or transactions, (2) to modify an instruction so that the address numbers it contains are increased by a stated amount each time the instruction is performed.

verifier, a device on which a record can be compared or tested for identity character-by-character with a retranscription or copy as it is being prepared.

write, (1) to transfer information, usually from main storage, to an output device; (2) to record data in a register, location, or other storage device or medium.